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UNIVERSITY OF ALBERTA

WRITING TO LEARN: SCIENCE JOURNALS IN YEAR ONE

BY

ANN M. OZDOBA

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A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of MASTER OF EDUCATION.

DEPARTMENT OF ELEMENTARY EDUCATION

Edmonton, Alberta
FALL 1992

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled WRITING TO LEARN; SCIENCE JOURNALS IN YEAR ONE submitted by ANN M. OZDOBA in partial fulfillment of the requirements for the degree of MASTER OF EDUCATION in ELEMENTARY EDUCATION.

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Dr. P. Rafferty

Dr. M. Iveson

SEPTEMBER 1, 1992

Dedication

To Melanie
May you inherit the
love of learning.

Also
To my loving husband, Dale,
and my supportive parents, Eva and Walter Meyer.

Abstract

The purpose of this study was to describe the writing experiences of five 6-year-old students, in Grade 1, when a science learning journal was introduced after completing hands-on experiments. The aim was threefold: to gain insight into how the children viewed and used their science learning journals; to see if their journal entries changed or developed in any way; and to see if there were any outside factors that influenced their journal writing over the course of the three-month study. For this study, ethnographic data collection procedures were used including participant observation, field notes, transcripts, interviews and document analyses. These ethnographic methodologies help remind the researcher of the importance of each child's view of reality and each child's cultural knowledge which in turn influences actions and learning (Smith, 1983). The analysis of the data suggests: (a) talk played an important role in the students' learning and writing; (b) the children's illustrations preceded and then supported their writing; (c) science learning journals assisted children to explore ideas, predict, and assimilate new information; and (d) the children enjoyed and viewed their journal writing as valuable to their learning. This study suggests that writing is not an isolated activity that can only be used in language arts. Writing to learn can be used in all subject areas and can be the key that unlocks the door segregating our curriculum. Through writing, children can explore connections with prior knowledge and connections with subject areas.

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Chapter 1
INTRODUCTION

We all acknowledge the importance of language in every aspect of our lives. We need language to function effectively in our world and we accept the theory that language is entwined "with our mental life--our perceiving, our remembering, our attending, our comprehension, our thinking--in short all of our attempts to make sense of our experiences in the world" (Lindfors, 1987, p. 8).

James Britton has written much of the literature dealing with the importance of language in learning. Britton (l970) stated that "language is our principal means of classifying and it is this classifying function that goes the farthest towards accounting for language as an organizer of our representations of our experiences" (p. 23). He continued by saying that this organization enables us to understand our experiences and allows us to apply this information in making more accurate predictions in the future. Vygotsky (1978) also believed that language is an expression of our thinking and a vehicle for making meaning out of our thoughts. In Fillion's words, "language is the exposed edge of learning" (1983, p. 702). Britton and Vygotsky were instrumental in establishing the important link between language and thinking, and in stressing that language is a powerful tool for learning.

As a result, current literature has stressed the importance of having students express ideas by using their own language to represent what they are learning. Britton (1980) once said that if we don't give students that opportunity, we are asking them "to limp around in someone

else's language in hopes that eventually it will fit." We need to translate ideas into our own words in order to make the information personal and easier to connect to our own experiences.

Prior to this study, I had spent a considerable amount of time reading the writings of Britton (1970, 1975, 1990), Donaldson (1978) and Vygotsky (1978). This made me question how I was using language, in particular, writing, in my Grade 1 classroom. I felt I had not given my students the opportunity to explore their ideas in various subject areas through expressive writing. I therefore decided to try to add a writing element to my science program two years ago.

My first attempt at writing to learn in science was to provide each child with a logbook that was 12 pages long; each page had a specific purpose. We would work on our logbooks as a class and the children seemed to enjoy the idea of taking something home that explained what they learned. I found the logbooks to be a long, laborious project which resulted in each child having the same piece of writing. I realized that all I had accomplished was to develop another variation on a copying exercise.

The next year, I still felt it was necessary to provide the framework of the logbook to the children because I thought it was important to the thinking process. We wrote the first pages together but the students wrote their own observations and applications of the experiment. The children seemed to enjoy the latter pages more and I concluded that the reason for this was that the students had more control over which aspects of the experiment and their learning that they wanted to write about. In addition, they were each using their own language to explain their learning. They were able to choose

the information and facts that were important and meaningful to them.

After the second year of using logbooks, I still felt uncomfortable with the format, as it seemed to limit the students' opportunity to engage in expressive writing. My reading at this time seemed to indicate that a less-structured subject journal might be more suitable to encourage children to use writing to learn. I had hoped the science learning journal would allow the students the freedom to explore their ideas and to express their understanding in a more comfortable and enjoyable format. It was at this point that I formulated initial plans for a more open-ended subject journal.

Purpose of the Study

The purpose of this study was to describe the writing experience of five Grade 1 students, when a science learning journal was introduced after hands-on science experiments. It was hoped that the study would offer some insight into how the children viewed and used the science learning journal. I also wanted to determine if the children's journal entries changed or developed in any way, and if there were any outside factors that influenced the process of journal writing over the course of the three-month study.

Design of the Study

For this study I chose to use ethnographic data collection procedures which included participant observations, field notes, transcripts, interviews, and document collection, in an attempt to gain insight regarding how children reacted to, viewed and used science learning journals. These ethnographic research methodologies helped to remind me of the importance

of each child's view of reality and cultural knowledge, which in turn influences actions and learning (Smith, 1983).

I began this study in the role of participant observer. During the students' Language Arts period, I would choose a spot from which I could make observations, take field notes, and interact with the children while they worked. After the first month of the study, my role changed to that of complete participant, as I undertook the dual role of teacher and researcher. Spradley (1980) defines a complete participant as a researcher who studies "a situation in which they are ordinary participants" (p. 61). The role of teacher researcher gave me the opportunity to alternate "between the insider and outsider experience and having both simultaneously" (p. 57).

Analysis of Data

"Analysis of any kind involves a way of thinking. It refers to the systematic examination of something to determine its parts, the relationship among parts, and their relationship to the whole. Analysis is a search for patterns" (Spradley, 1980, p. 5). In analyzing my data I employed Spradley's ethnographic research cycle of selecting a project, asking ethnographic questions, collecting data, making an ethnographic record, and analyzing the data (p. 29). It was through this process that I was able to detect recurring patterns in my observations, transcripts, journal entries and interviews.

Significance of the Study

Writing to learn has been explored and discussed for almost twenty years; however, there is very little evidence of it being encouraged or used in elementary schools. Research by Britton (1975), Applebee (1981), and Jackson (1982) concluded

that students' writing in school consisted mainly of taking notes, writing reports, and copying from the board, while very little writing was used for making observations, speculating or theorizing. Schools were giving very little thought to how students could use writing to learn. Currently, however, journals are becoming a common feature of many primary classrooms, in an effort to have children engage in expressive writing. Little research exists on the effectiveness of journal writing in curricular areas at the primary level. Therefore, there is a need for research in order to develop our knowledge of how to use journal writing in specific subject areas. Hopefully, this study will provide some insights to help broaden our understanding of subject journals and writing to learn in science.

Chapter 2
LITERATURE REVIEW

Language Across the Curriculum

Writing in schools has traditionally been "viewed as a discrete collection of skills" (Mayher and Lester, 1985, p. 717) that need to be taught. The purpose of writing in schools was, in the past, to effectively communicate what one had learned to the teacher. Writing wasn't viewed as having a role in actually helping children to learn.

The writings of Britton (1970) and Vygotsky (1978) established a link between language and learning in which writing had an important role. They suggested that through language we are able to represent, structure, organize and internalize events in our lives. This process allows us to classify our experiences so that we can see relationships between events and therefore make sense of them.

As the educational world accepted the importance of language in learning, theorists began to explore the many facets of writing, as it is a very visible and permanent form of language.

Britton (1970), Smith (1982), Emig (1977), and Thaiss (1986) agree that when writing, we are actively involved in our own learning. Writing allows us to sort out our ideas, reflect, examine and develop them. It is a way of making sense for ourselves (Britton). Because writing is permanent we can then share our ideas with others, and go back to reflect on it ourselves.

As a result of the work of Britton, Barnes, Rosen and others, the language across the curriculum movement began.

The British Department of Education and Science (DES) published the 1975 Bullock Report, A Language for Life, which was an extensive study conducted in British schools. The report recommended that "each school should have an organized policy for language across the curriculum, establishing every teacher's involvement in language and reading development throughout the years of schooling" (p. 514). It also gave suggestions as to how this language policy could be implemented in the schools. Proponents of language across the curriculum "[point] out that we often fail to [encourage] students' language--especially informal, expressive talk and writing" (Fillion, 1983, p. 702). The language across the curriculum movement had three major tenets: (a) language develops primarily through purposeful use; (b) learning occurs through talking and writing; and (c) language use contributes to cognitive development (Fillion, p. 703). The philosophy behind language across the curriculum was adopted by, and could be found in, many documents used in education. One such National Association of Teachers of English (1976) document stated:

> Theory and practice suggest. . . a learner at any level is able to make his own formulations of what he is learning. This is more valuable to him than talking over someone else's pre-formulated language. In practice, this means that the pupils often need to have the opportunity to say or write things in their own ways, in their own styles, rather than copying from books or taking notes from dictation. (p. 7)

Even though this philosophy was included in documents such as the above, studies indicated that it was not present in the schools. Research by Britton (1975), Applebee, Lehr and Auten (1981), and Jackson (1982) concluded that students'

writing in school mainly consisted of note-taking, reports and copying from the board, while very little writing was used for making observations, speculating or theorizing. Schools were giving very little thought about how students could use writing to learn. Moffett (1988) states that writing "in one form or another, from first grade through graduate school, serves mostly to test reading. . . because writing produces an external result, it is a natural testing instrument if one wishes to regard it so" (p. 73). Britton agreed with Moffett when he stated:

> Often teachers use writing as a way of testing. They use it to find out what students already know, rather than as a way of encouraging them to find out. The process of making the material their own--the process of writing--is demonstrably a process of learning. (Mayher, Lester & Pradl, 1983, p. 86)

The interrelatedness of language and learning has applications for students of all ages. Proponents of language across the curriculum view the learner as actively involved in learning, using language to learn. Language across the curriculum doesn't mean stressing more grammar, punctuation and vocabulary in all subjects. It rather means allowing the children to engage in peer discussions and using writing in order to learn. Learning is viewed as being constructed by the learner as she personalizes her learning by putting new experiences and ideas in her own words (Britton, 1970).

Talking to Learn

Proponents of language across the curriculum advocate that children should interact with others as they work. Mayher, Lester and Pradl (1983) believed that thinking through talking is a natural process:

> Talk stimulates more talk: when we hear other people responding to what we say. . . we formulate answers and respond. Ideas, feelings, thoughts that might never have occurred to us pop into mind during conversations, because someone provokes us to talk farther. (p. 39)

Britton (1970) stated that it is through talk that each person makes sense of experience by relating it to past experience and "creating a personal context for it" (p. 30). He believes that talk also plays a crucial role in problem solving and learning, so in classrooms children need many opportunities to discuss ideas and thoughts. Britton agrees that while the children are engaging in talk they are (a) learning to use language, (b) personalizing knowledge, and (c) learning to make sense of the world.

Barnes (1975) stressed the importance of exploratory and collaborative talk in allowing students to become actively involved in their own learning. He stated that often teachers are presenting tasks that they feel will assist the students' learning. He agrees that the teacher doesn't know the students' existing views on a subject; therefore "it is important for the learner to talk or write or otherwise represent the problem to himself" (p. 83) so that the new information can be personalized. This information then becomes action knowledge (Barnes, 1975) which the student can use.

Barnes (1975), Lindfors (1987) and Booth and Thornley-Hall (1991) all stressed the importance of students' talk. It is through interacting with peers that students focus attention, explore, clarify, refine, organize, think, share, elaborate, compare and support each other. Talk is important to the students as they make sense of the world.

Wells (1985) stated that learning should be a collaborative process in which the students talk and work together to solve problems and learn. "Life in school [is] more challenging and rewarding when learning is seen as a collaborative activity in which all participants are recognized to be actively and responsibly engaged in the making of meaning" (p. xi). He also says that students come to school as active, self-directed learners. Providing them opportunities to talk and work with others is taking advantage of skills already in place. He states that this type of interaction helps students "to develop a broader range of interests and more powerful skills and strategies for exploring them" (p. 175).

Dudley-Marling and Searle (1991) wrote about the link between talk and learning. They too stressed the importance of providing for discourse between students. They stated that this is how students become more aware of their own thinking and add on to their peers' ideas.

Booth and Thornley-Hall (1991) compiled a collection of research that resulted from a three-year project to explore talk, established by the Ontario Ministry of Education and the Peel Board of Education in 1988. The research included in their book supported providing opportunities for students to talk and stated that it benefitted the students' learning as it broadened their knowledge base. The research also made a point of the importance of the teacher taking time to listen to the children instead of always talking to them.

Finlay (1992) described how talk played an important role in her Grade 9 Humanities class. She stated that the students used talk to explore and to clarify their ideas; to brainstorm; and to help one another. They relied on each other to learn. Finlay said her students often didn't "speak in complete sentences and sometimes, in their enthusiasm to

piggyback on what was being said, they interrupted each other" (p. 5). However, she felt it was a valuable learning process.

Besides talk being used as a medium for thinking (Vygotsky, 1978), it also develops a lively learning environment where everyone is both a teacher and a learner (Calkins, 1986). Bruner (1971) stated:

> A community is a powerful force for effective learning. Students, when encouraged, are tremendously helpful to each other. . . and mutual learning and instruction can occur within a classroom with its own sense of compassion and responsibility for its members. (p. 20)

Rosen and Rosen (1973) said talk "serves not only to teach children about others and how to live with them, but, as it knits groups of children together, it makes new kinds of communication and learning possible" (p. 43). Dudley-Marling and Searle (1991) believe it allows the children to feel safe with each other so that they can take risks and not worry about being wrong. Everyone in the classroom benefits from the rich learning environment.

Writing to Learn

Researchers generally agree that writing to learn is an important component of language across the curriculum. They maintain that writing must be viewed as a set of symbolic signs that represent meaning (Vygotsky, 1978). It is important that we continue to define writing as a process of meaning-making in order to recognize the important role of writing in learning.

"Learning is a process of sorting out information acquired through experience and incorporating this knowledge into a previously constructed view of the world. The vehicle

by which this reconstruction is carried out is expressive language" (Walker, 1988, p. 96). Expressive language can take the form of talk and/or writing. In either form, "expressive language should be the vehicle by which new learning is acquired in the classroom as elsewhere in the world" (p 96).

Britton (1970) stated that expressive language is the voice closest to us and the one we feel the most comfortable using because it is tied to the context of what we are doing. Expressive language is informal and it is often directed just at ourselves. If we are using it with others, they are usually people we know well and they understand the context of our utterances and writing. When using expressive language we don't worry about conventions, or organizing our ideas. It is the voice we use to deal with new information so that we may wonder, hypothesize, and experiment as a way of trying to find relationships with previous knowledge and experiences.

Britton (1975) suggested that all writing is shaped by our past experiences. He believes we draw on our past experiences which we have already shaped and interpreted when we read our writing, therefore enabling us to reflect and organize our ideas more easily. Murray (1985) also saw writing as a powerful learning tool. Murray agreed that when we write down our ideas, feelings and experiences, we then can stand back and examine our thinking. This separation allows us to theorize about our ideas or see connections in a way that we can't while we are talking. Britton (1975) stated that expressive writing is best used for exploration and discovery. It is often used when trying to solve problems or reflect on experiences. Britton feels that through expressive writing we begin to draft some of our most important ideas. We are using our writing to assist our learning. We write down our:

> half-formed ideas, thoughts and observations and it is then that we can go back and re-examine the ideas we captured there, reflect upon them, refine them, and build on them as we integrate new ideas and new knowledge into the old. (Edwards & Rosell)

Emig (1977) believed it is through expressive writing that students begin to hear and develop their writing voice and begin to learn. She stressed that it is the writing process that is so important to thinking, and which aids learning, not the written product". Donaldson (1975) believed that an awareness of written language will "also encourage awareness of one's own thinking and be relevant to the development of intellectual self-control, with incalculable consequences for the development of all kinds of thinking. . . "(p. 95). Donaldson also saw writing as a way of storing our ideas so that they will not be forgotten and the mind can then have time to see connections and embellish ideas.

Britton (1982) and Barnes (1975) believed that students can write their way into learning. They also believed that a writer doesn't always know what ideas will come to mind, so, as we write we are able to capture our thoughts and shape them as they form. Writing down our ideas forces us to focus on them more than simply talking about them. Donaldson (1978) suggested that since a mind can only think of one thing at a time, writing helps capture our ideas so that they are not forgotten when the mind goes on to think of other.things. "Writing permits ideas and events to be created and manipulated in ways that would not exist if all language had to be transient as thought or spoken words" (Smith, 1982, p. 15). Writing to learn allows us to re-examine and develop our ideas as we grow in our learning.

Writing may also help us reflect on ideas received from others. Britton (1980) stated that we don't truly understand until we put ideas into our own words. It is then through writing that we can translate the ideas of others and make them more personally meaningful. The experiences of others are fitted into our own framework of understanding, and this allows us to connect our experiences with someone else's.

Britton (1970) stated that the process of organizing information on one's own is a crucial part of writing to learn. Writing brings order, understanding and meaning to the children's thoughts and new experiences. When children write, they are internalizing information and making it external so it can be held for reflection and learning. Writing also enables the students to see connections and ideas which might have otherwise been elusive and abstract before (Wason-Ellam, 1987; Collins, 1985).

D'Arcy (1989) said, "I happened to have spent most of the past decade encouraging students and their teachers to think of writing as meaning-shaping activity, a way of making thinking visible" (p. xi). She stated that it is through writing that young writers discover how to make sense of new information, concepts and past experiences in order to "arrive at fresh perceptions about themselves and their world" (p. xi). D'Arcy stressed the importance of young children "experimenting through writing how to express their thoughts because this process simultaneously helps them discover what [their] thoughts are" (p. 98). She feels that too often we ask children to write about other's ideas and not their own.

As a result of the research and discussion about using writing to learn, many researchers (Applebee, 1984; Fulwiler & Young, 1982; Martin, 1984) began studying writing for

learning in all subject areas. Applebee stated that writing as a means of learning is successful for the following reasons:

1. [It] allows the writer to rethink, to revise, and to develop his thoughts over an extended period.
2. The explicitness required in writing forces the writer to sharpen hazy thoughts and perceptions so that they can be put into words.
3. The conventional forms of discourse provide resources for organizing and thinking through new ideas or experiences and for explicating the relationships among them.
4. Writing requires active participation by the writer. (p. 577)

A number of recent studies have explored writing to learn at a variety of grade levels. One such study by Crowhurst in 1989 involved 90 education students who were enrolled in a compulsory Language Across the Curriculum university course. The students had majored in a variety of subject areas from science, social studies, and music, to business education. The students were to find ways of implementing writing to learn in their subject area. Most of the students introduced subject journals to their students as a way to use writing to assist learning. Many of the education students were very sceptical at the beginning of the study; however, at the conclusion of the study, they felt very positive about incorporating writing into their learning tasks. Crowhurst concluded her study by stating that writing to learn was not always easy to implement but was well worth the effort.

Collins (1985) used writing to learn to assist students' reading comprehension. She concluded that "writing brings order, understanding and meaning to one's thoughts and experiences" which means that "writing processes internal

information, makes it external and holds it in graphic relief for reflection and learning". She stated that "students who write expressively are thinking on paper" which allows them to see relationships and connections that "once were elusive and abstract" (p. 52).

Talbot's (1988, 1990) study also indicated that using writing to learn in language arts is difficult but very beneficial to the students. He stated that teachers need to ignore the pressures that encourage them to take shortcuts to improve children's writing for "if we truly want [children] to improve their writing, they must see the value in doing" it (1990, p. 56). Using writing to learn is one way for students to understand the importance of the link between writing and their learning.

Journal Writing

Fulwiler (1987, 1982, 1980) has written extensively about the benefits of journal writing in assisting children's learning. He states that journal writing in subject areas serves three purposes:

1. When children articulate connections between new information and prior knowledge, they learn and understand the new information better. (Bruner, 1966)

2. Writing about new concepts and ideas help children learn and understand them better. (Britton et al., 1975)

3. When children care about what they write about and see connections to prior knowledge, they learn and write better. (Moffett, 1968)

Fulwiler (1982) referred to journal writing as somewhere between a personal diary and a class notebook. The writer uses expressive writing to record ideas, thoughts, and observations while learning. Other writers refer to this type of expressive writing as learning logs, writer's notebooks, or simply logs (Fulwiler, 1980). He stressed that the idea of journal writing is for the writer to write about what he/she feels is important.

Fulwiler (1980) studied journal writing and explored how it could be implemented across content areas. He stated that journal writing is an effective way for students to keep a running account of their learning in a subject area. He stated that "journal writing works because every time students write, they individualize instruction" (p. 16).

Fulwiler (1980) stated that journal writing cannot occur unless the students are actively involved in their learning. Barnes (1975) also believed that the act of writing means writers must take an active role in their own learning. Journal writing will make active learners, because of its personal nature, it is difficult to be passive. If the interdisciplinary journals are kept regularly and seriously it would be impossible not to witness some growth (Fulwiler, 1980).

Yates (1987) agreed with Fulwiler (1987, 1982, 1980) and added that journal writing is "especially important in the learning process because [it] affords students the opportunity to describe and explore their own experiences and to record their opinions, impressions, insights, questions, musings, feelings, or interpretations" (p. 12) with regard to their experiences and learning. Yates stated that writing in journals provides opportunity for "lively interaction between learner and subject" (p. 12) and gives the children an experience that broadens their knowledge.

Bowman (1983) stated that the purpose of a journal is to mirror the mind, which forces writers to see and confront themselves. He believes this gives the students control over their learning which allows them to ask questions related to the subject being studied. "Student journals are particularly effective in shaping daily classroom activities to permit students to achieve more active, involved roles in the learning process" (p. 26).

D'Arcy (1987) stated that journals are for reflection, rehearsing, reshaping and redrafting of ideas and thoughts. She sees writing as a scaffold on which other ideas can be built. As we re-read journal entries we re-examine the ideas we've captured, reflect upon them, refine them and integrate new ideas and concepts. D'Arcy argued that writing is an integral part of the learning process; therefore writing should be done <u>while</u> one learns rather than <u>after</u>.

Fulwiler (1982) suggested that students write in their journals at the end of class in order to encourage them to summarize what they have learned that day. He states that this synthesizing process forces unconnected thoughts into a tighter and clearer form. Pradl and Mayher (1985) also suggested that the students write for the last five minutes of every class. The children should write about what they have learned as well as record any questions they may have.

Fulwiler (1982) concluded that students use their journal writing as a way of understanding problems by "forcing their confusion into sentences" (p. 21). He suggested that as students write in their journals about difficult ideas and concepts, the process itself acts as a confusion-eliminating, meaning-finding device.

Bruner (1988) said that expressive writing, like that found in journals, is a natural way to think, organize and

construct meanings. He stated that encouraging students to write expressively enhances their development as critical thinkers, writers and learners.

Atwell (1990) compiled a number of studies that incorporated journals or logbooks into elementary subject areas as a way of using writing to learn. The results were very positive and all the researchers felt that writing was a tool "of the highest quality for helping children come to know about the world" (p. xxii).

Evans (1984) studied journal writing in mathematics with a group of Grade 5 students. She felt "writing [could] be a powerful learning tool" (p. 828), so she had the students write directions and definitions, and explain mistakes in their journals. Evans discovered that the students had a higher retention rate than the control group. She stated that we can get students to "own" knowledge rather than just "rent it" (p. 835) if students write while they are learning and figuring out new concepts.

Wason-Ellam (1987) conducted a study using journal writing in mathematics with a classroom of Grade 1 students. She discovered that the journals served four distinct purposes for the children: self-questioning; organizing information; assimilating and accommodating new learning; and making guesses or hypotheses. Wason-Ellam stated that she felt the writing was worthwhile and enhanced the children's mathematical abilities and understanding. "Writing to learn demands a view of learning which is active and personal. . . knowledge was a personal possession based on the knower's experience. This is different from memorizing, transcribing and reciting" (p. 23).

Edwards (1992a) studied dialogue journals in mathematics with students in Grades 2, 4 and 6. At the end of

the year-long study, she noted that the children made connections to prior knowledge and began to ask their own mathematical questions through their journal writing. Edwards concluded that if the use of dialogue journals is modelled for students, the journals can be beneficial in assisting children's learning and understanding of new concepts.

Edwards and Rosell (in press) also studied journal writing in mathematics with a group of Grade 1 students. They identified five aspects of the children's writing that developed over the course of the year: awareness of audience; writing that reflects reading; work moving from drawing to writing; connections to prior learning; and enthusiasm for writing. Edwards and Rosell also concluded that young children can use writing to explore and assist their learning of new concepts.

Edwards and Blawatsky (1991) studied writing in social studies with four Grade 2 students. They conducted a pre-study with these students and discovered that they very rarely wrote outside language arts and if they did it was on a worksheet or copied from the board. For the study, the students wrote in journals, made lists and wrote questions. Edwards and Blawatsky concluded that "writing. . . does bring knowledge and understanding" (p. 21) as results of the study showed that the children who participated learned more, saw the purpose of the writing, and enjoyed it.

In summary, the literature reveals that journal writing is seen as a tool that encourages critical thought and self-evaluation (Fulwiler, 1982). It is often taken for granted that teachers and students instinctively use journals effectively. However, in Edwards' (1992b) study, the teacher and the students were unsure as to how they could utilize journal writing to assist in their learning. As a result, the teacher

and the students both became dissatisfied with journal writing and abandoned their journal writing project. Heath (1988) found that her students experienced the same frustrations. Heath continued to try different approaches to journal writing and after three years was "convinced that daily, somewhat structured journal writing can produce successful writers" (p. 60). Both Edwards and Heath felt journals were a valuable learning tool but saw the need for the teacher to provide some structure to the journals in order to help the children learn through writing.

Chapter 3
METHODOLOGY

The purpose of this chapter is to describe the methodology used to support the intentions of this qualitative study. The research design and its implementation will also be included.

Purpose of the Study

The purpose of this study was to describe the experience of writing for five Grade 1 students, when a science learning journal was introduced after a hands-on science experiment. In order to explore this experience it was necessary to do extensive observations in the classroom setting. These observations enabled me to capture the children's experiences as they naturally occurred.

I was interested in, and sought to describe and understand, how the children reacted, viewed, and wrote in their science learning journals. I wanted to determine if the children's journal entries progressed or changed and if there were any outside factors that influenced this process over the course of the three-month study.

Research Design

Ethnographic data collection procedures (Spradley, 1980) were used in the role of complete participant (teacher researcher) in order to articulate understandings about the children's reactions, views, and uses of science learning journals. Hammersley and Atkinson (1983) state that triangulation is the collection of "multiple types of data [that]

are related to each other to support or contradict the interpretation and evaluation" (Eisner, 1990, p. 110) of the situation being studied. Triangulation is then a strategy for control of data collection which is incorporated into the research design to allow more confidence in conclusions. The gathering of data adhered to naturalistic principles, which means that "the researcher frequents [the] place where the events he or she is interested in naturally occur" (Bogdon and Biklen, 1992, p. 3). In the naturalistic paradigm, researchers believe that when collecting data:

1. It allows behavior to be recorded as it occurs in the natural environment.
2. It permits the recording of "the stream of behavior" so that whole events are preserved.
3. It allows the routine of the activity to be observed and recorded. This routine may be the key to the understanding. (Duignan, 1981, p. 290)

I was concerned with exploring how the children viewed their writing and used the science journal, as well as exploring any external influences that may have been present (Bogdon and Biklen, 1992). Ethnographic research methodologies help to keep in mind each child's view of reality and in doing so build continued awareness of each child's cultural knowledge and how it influences learning (Smith, 1983).

Gaining Entry

For my setting I chose a teacher with whom I had team-taught for two years. Mary and I had discussed my study before I went on professional leave. She expressed an interest in exploring the effects of a science learning journal and felt

the experience would benefit her students and herself. She therefore agreed to a commitment to a three-month study.

After Mary had given her permission for me to work with her and her students, we met with the principal of the school to explain my study. He readily gave his permission and felt it would provide a good learning experience for everyone involved. After gaining permission from the School Board and the University, I sent a letter to all the students and their parents requesting permission for their participation. In this letter I explained my study and that I would assume the role of their child's science teacher while Mary would stay in the classroom as assistant. I also noted in the letter that I had the support of Mary and the school's principal.

I was very fortunate to be conducting my study in a school in which I had previously taught, because the students and their parents had no trouble in accepting me as the science teacher. The children accepted Mary's and my note-taking as a part of the science program and I felt that this did not affect the children's behavior. The children seemed to go about their daily activities as usual and didn't show any interest in our writing.

Role of the Researcher

I interacted with the students, as Spradley (1980) identifies, as a complete participant. He describes complete participation as a situation where the researcher studies "a situation in which they are ordinary participants" (p. 61). The teacher researcher would alternate "between the insider and outsider experience and having both simultaneously" (p. 57). Bissex (1986) agreed with Spradley when she stated, "A teacher researcher is not a split personality, with a poem in one hand and a microscope in another . . . A teacher researcher

is an observer, a questioner, a learner, a more complete teacher" (p. 483).

"By participating, the researcher gets the feel of what it is like to be an actor in the social situation and is able to comprehend and understand behavior" (McKernan, 1991, p. 63). As a teacher researcher, I had the opportunity for complete participation. I had taught Grade 1 science for six years and was familiar with the curriculum expectations. I was therefore able to interact with the students in a meaningful manner. My familiarity with the program also allowed me to concentrate on my five focus students.

However, when I began the observations, I did so in the role of observer (Spradley, 1980) for the month of October. I had "two purposes in mind: (1) to engage in activities appropriate to the situation and (2) to observe the activities, people and physical aspects of the situation" (Spradley, p. 54). I began taking descriptive field notes about the social situation, including details of the students' behaviors, interactions and reactions to personal journal writing, as well as keeping a personal journal myself. Participant observation allowed me the opportunity to get to know the children and their writing. The students in turn became comfortable with my presence in their classroom and accepted me as an insider.

From November until the first week in March, I assumed the role of complete participant as I had the dual role of teacher and researcher. The transition from participant observer to complete participant was smooth, as the students had no trouble accepting my new role. Even though I was teaching the science classes, the children were very independent workers and were able to carry out the science experiments and journal writing with very little assistance. This allowed me the opportunity to continue to make

observations, write field notes, and write in my journal. During this time I audiotaped and transcribed the children's interactions and photocopied their journal entries.

Research Schedule

October 22, 1991 was my first classroom visit. I observed the students three times a week for four weeks during the morning, which was their language arts period. These observations allowed me the time to get to know the children and their writing. I was also able to interact with the students while they wrote.

From November 20, 1991 to March 4, 1992 I assumed the role of the science teacher. I taught science lessons twice a week. These were either one hour or one and a half hours in duration. At the end of each lesson, Mary and I would compare field notes, discuss students' science journal entries, and review plans for the next lesson.

During my first week of teaching the whole class, Mary and I chose five students on whom we could focus our observations. Our choice of students was based on the following criteria:

1. Showed interest in science
2. Was comfortable and talked freely with the researcher
3. Was of average ability in all subject areas
4. Was a cooperative student
5. Included boys and girls.

I centered my observations and interactions on these five students. However, because of the nature of the study, I interacted with all the students. Significant interactions with

students other than the focus students will be included, since much relevant and helpful data was collected from them.

Data Collection

For this qualitative study I used a variety of ethnographic techniques for data collection. Field notes were kept on students' science activities and journal writing, as well as on behaviors and interactions of the whole class, small groups, pairs and individuals. Tape recordings were made of class discussions, of my informal talks with students, and of the interactions among children both during group work and while writing in their science learning journals. I kept a personal journal and photocopied all the students' science learning journal entries as well as cards and notes students had written to me during the course of the study.

The variety of data sources was necessary in order to provide triangulation which is an approach by "which multiple types of data are related to each other to support or contradict the interpretation and evaluation" (Eisner, 1991, p. 110) of the situation being studied. By using a variety of sources the researcher can feel confident about observations, interpretations and conclusions. Eisner believes it "breeds credibility" (p. 110) into the study and also helps secure a more penetrating grasp of the setting.

Field Notes

Spradley (1980) suggests that researchers should keep condensed and expanded field notes in order to "capture a slice of life" (Bogdon and Biklen, 1992, p. 119). Geertz (1973) stated that expanded field notes contain thick description, which means a description, in great detail, of everything the

researcher sees. Bogdon and Biklen believed that this approach is aimed at helping the researcher get "below the surface" (p. 15).

During my study, both the classroom teacher and I kept condensed field notes. The reason was that since I was teaching the class, I didn't always have the opportunity to write. By having two sets of condensed notes I was able to check my perceptions as well as write a more comprehensive expanded account of the lesson, and of students' behaviors and interactions. I wrote the comprehensive field notes immediately following each session.

During science lessons I had four tape recorders working. I transcribed these tapes after each lesson and found these recordings complemented my field notes. The recordings also provided me with the complete context of the children's discussions, as I was often somewhere else in the room when interesting discussions were starting or taking place. The students quickly accepted the presence of the tape recorders and, for the most part, forgot they were there.

Personal Journal

My personal journal gave me the opportunity to record my observations, experiences, ideas, feelings, problems, and insights. I also recorded discussions I had with other individuals who were not involved in the study. Elliott (1991) states that journals "help one to reconstruct what it was like at the time" (p. 77).

Interviews

"Interviewing is a good way of finding out what the situation looks like from the other point of view"(Elliott, 1991, p. 80). This was certainly true of my formal and

informal interviews with my five focus children. I conducted the formal interviews at the end of the study, when the students felt very comfortable and at ease with me. The interviews were therefore more like conversations (Bogdon and Biklen, 1992).

During my formal interviews with the children I treated them as experts at using science learning journals. I told them I needed to learn from them what writing in a science journal was like. Spradley (1979) describes this as "I want to understand the world from your point of view. I want to know what you know in the way you know it" (p. 34).

Spradley (1979) writes of the value of asking descriptive questions that "seek the relationships among entities that are conceptually meaningful to the people under investigation" (p. 84). Descriptive questions should be broad and general to encourage the informants to talk about their experiences using their categories. I tried to start my interviews in this manner using questions such as: "What do you think of science?"; "Tell me about writing in your science journal"; or "Can you tell me what you do in your science journal?" I found some of these questions to be successful, while others I had to rephrase or change so that it would have meaning for that individual student.

After reviewing the results of the descriptive questions, I was able to formulate structural and contrast questions for the students. I found that the students' answers to these questions provided me with valuable insights into how they reacted and viewed their science journals.

Use of Documents

I made photocopies of all the students' journal entries and kept notes and cards they gave me during the course of the

study. Mary gave me access to their writing files, which contained writing samples from kindergarten to the present, and to their personal journals. This provided me with writing samples that I could compare with their science learning journal entries.

All journal entries included in this thesis have been reduced by fifty percent.

Data Analysis

In qualitative studies it is recommended that data analysis be ongoing throughout the study (Bogdon and Biklen, 1992; Spradley, 1980). This process is described by Spradley as the ethnographic research cycle. First, the researcher is to narrow her study by focusing on a question that she is interested in. As my study progressed I became very interested in how the students used writing to learn and how they viewed their science learning journals, as well as in what factors affected the students' journal writing. Next, Spradley states that a researcher should ask herself ethnographic questions, gather data, make an ethnographic record, and finally analyze ethnographic data. This analysis could lead the researcher back to asking questions (p. 29). I found for my study I needed to go through the ethnographic cycle a number of times to fill gaps in the data and to test themes. I achieved this by reading field notes, my personal journal, documents, and transcripts numerous times until recurring patterns became evident. The themes appeared in my journal, field notes, documents, and transcripts, and were then confirmed through the students' interviews and observations.

Spradley (1980) states that by asking contrast questions, the researcher can discover "dimensions of

contrasts" (p. 127). Contrast questions may be dyadic, focusing on the difference between two domains, or triadic, focusing on which two of three domains are alike. Some of my contrast questions were: "What is the difference between a science journal and a personal journal?" and "How is writing in a personal journal different from writing in a science learning journal?" I found the questions helped focus my observations and formulate questions for student interviews. I took the information from this data and used it to analyze the students' science learning journal entries. It was through this process that I came to understand and see recurring themes: (a) talk played an important role in students' learning and writing; (b) children's illustrations preceded, then supported, their journal writing; (c) children captured ideas, made predictions and assimilated new information in their science learning journals; and (d) the children enjoyed writing and viewed it as assisting their learning.

Generalizability to Other Contexts

Guba (1981) states that generalizations in a rationalistic sense are "truth statements that are context free--that hold in any context . . . are not possible [in a naturalistic study] because phenomena are intimately tied to the times and the context in which they are found" (p. 10). He suggests that we use the term transferability. Patton (1990) states that transferability comes from extrapolations which are "modest speculations on the likely applicability of findings to other situations under similar, but not identical, conditions" (p. 489). As Eisner (1991) states, "the logic in qualitative studies is softer--if more analogical" (p. 204). Therefore, the receivers need to determine if the research findings fit their own particular situations.

Chapter 4
SETTING OF THE STUDY

This chapter will describe the classroom setting in which a heterogeneous group of 24 Grade 1 students of various socio-economic backgrounds participated in this study. It will include an introduction to the five focus students of the study.

Classroom Setting

When I made my initial visit to Mary's classroom I was struck by the cheerful atmosphere. Three walls in the room were covered with children's art work, and their writing was mounted on brightly colored paper; posters promoting friendship and caring were hung amongst the students' work.

The students worked at round or rectangular tables, in groups of four or five, which was a reflection of Mary's philosophy. She believed that children learn best when they are encouraged to work together in a safe environment. Mary worked hard on promoting a cooperative, caring, and safe environment through the implementation of the Pro-social and Quest programs. She spent most of September using these programs which stress modeling and provide planning activities that allow children to practice sharing. As well, cooperation, problem solving, and being kind to friends was valued and positively reinforced by Mary and her students. Therefore, working at tables was important to Mary's program and allowed everyone to be a teacher in her class.

The classroom had many quiet nooks in which individuals or pairs of students could choose to work. A low wooden storage box doubled as a desk in the coatroom. Two desks in

the front corner of the room were separated from the main activities. A writing center, underneath a wordboard near the window, was a bright, quiet place to write. Mary encouraged the children to find a quiet place to work if they felt a need for it. The children could work in the room or work in the library, on the lost and found box in the hallway, or in the art storage room across from their classroom. The choice of work areas was designed to provide opportunities for children to work collaboratively or individually as well as to encourage children to make good choices for themselves and take responsibility for their learning environment.

Mary had a number of centers in the room; a rice table, reading corner, math center, art corner and writing center. The children could choose to go to work at a center after they had finished their assigned task or in the afternoon during daily center time.

When I entered Mary's room I was impressed by how independent her students were. The children knew the classroom routines and were able to move smoothly from one activity to the next with very little teacher instruction. Therefore, Mary did very little direct whole class instruction. Instead she spent the majority of her teaching time with individual students or worked with small groups. The children handled the responsibility well and were very active in their own learning.

Framework for Science Lessons

I began this study with a constructivist view of learning. I believe that children are actively involved in constructing meaning. That "knowledge is not passively received, but actively constructed by the learners on a base of prior knowledge, attitudes and values. These are developed from and

shaped by personal experience and the social and cultural environment" (Betts, 1991, p. 2). I see learning as a social process in which children grow intellectually by explanation, negotiation, sharing and the evaluation of ideas (Bruner, 1986; Barnes, 1976; and Britton, 1970).

Having a constructivist view meant I had to re-evaluate my role as a teacher. I came to see my role as more of a guide/facilitator, with the task of helping the children focus attention by offering appropriate tasks and opportunities (Bruner, 1986). I felt it was more important to help the children to develop skills that would enable them to answer their questions than to give them the right answers. I needed to plan activities that allowed children to actively construct their own meaning from the material under study (Nussham, 1989).

Science Lessons

The Alberta Science Curriculum Guide (1983) recommends that science lessons be taught using an inquiry process, which compliments my constructivist view of learning. In the Guide, inquiry is seen as a "process of logical and ordered questioning" (p. 4) where the students ask questions and seek answers based on their interests in the unit being studied. It is felt that "science experiments should be based on enquiry and should involve students in developing and practising the process skills, in learning new concepts, in developing psychomotor abilities and acquiring positive attitudes towards science and self" (p. i). My science lessons incorporated the inquiry process set out in the Curriculum Guide, as follows:

Questioning
- Ask relevant questions
- Defining problems

Proposing Ideas
- Predicting
- Hypothesizing

Designing Experiments
- Identifying and Controlling variables
- Determine procedures

Gathering Information
- Observing
- Measuring

Processing Data
- Classifying
- Organizing and Communicating data

Interpreting data
- Inferring
- Formulating models
- Defining Operationally (pp. 4 - 5)

In the lessons taught as part of this study I introduced a unit on the study of change to the students. I asked the students what they knew about the chosen topic and if they had any questions. I recorded these on chart paper. Then, as a whole class, we designed experiments for each question, identified variables, made predictions, and conducted the experiment. I continued adding students' questions to the chart throughout the unit.

When I began teaching the science lessons using student inquiry, the real challenge was in getting the children to ask fruitful questions. At first, the children viewed the purpose of this activity as guessing what question I wanted them to ask. After a few lessons they realized that I accepted their interests and suggestions, and they became quite astute at asking productive questions that led to some very interesting experiments and discoveries.

The science experiments were conducted in pairs to give the students an opportunity to share. Booth and Thornley-Hall (1991) state:

> as adults, we use this medium [talk] to think aloud, to tentatively explore the beginning ideas, to "hitchhike" on what others have said, to clarify and modify our knowledge base, to affirm the thoughts of others, to acknowledge and enable speakers to continue groping for meaning. (p. 7)

I had always felt that it was important for children to discuss ideas with each other. Hence, including the opportunity for student talk in the study allowed me to analyze the children's discussions to determine how they were using talk and if it affected their journal writing.

Allowing the children time to work cooperatively was also important as it was in keeping with Mary's philosophy. I hoped this would add an air of familiarity to my lessons and make the students feel more comfortable.

Science Learning Journals

The format of the science learning journals used in this study was based on the work of Fulwiler (1987), Calkins (1986) and Atwell (1990). The journals consisted of bound scribblers that contained pages that were half blank and half lined. The children's journal entries were first-draft quality in which the students used invented spelling. The students were given focus questions: "What did you do?" and "What did you learn?" for their entries. The journal writing was to give students time to reflect on what they had experienced. As Fulwiler suggests, the journals were used as a vehicle for learning, not for evaluation. The journal was to "help children think of the relationship between themselves and the world

of. . . science--to use journal writing as a tool to generate their own knowledge" (Atwell, 1990, p. xviii).

In this study, after an experiment was completed, the whole class discussed their observations and results. The children then wrote in their science learning journals using expressive writing, as Britton (1975) states it is the most effective voice for students learning a new concept. He feels it closely resembles how we talk and write when struggling with new experiences. I found peer sharing, before the children wrote in their science learning journals, to be very important, and during our whole group share time, I asked questions that were meant to extend the children's thinking. I found that the children often went back and added information to their entries after a share session.

The students gave me their journals at the end of each class. I responded to each child's entry and wrote a comment or question. The children seemed to look forward to reading my comments and would respond to my questions which gave them an opportunity to clarify some of their ideas for themselves and for me.

Mini-lessons

Throughout the study I conducted mini-lessons (Calkins, 1986 and Atwell, 1987) , which were brief five- to ten-minute whole class meetings. The first few mini-lessons were on how to use the science learning journals and what questions to keep in mind. The students were also encouraged to make detailed drawings. During the remainder of the mini-lessons, I placed a student's journal entry on the overhead projector, and the class would indicate the positive aspects of the student's writing. As a group we also explored other ways of writing the information in the entry being studied. Over the

four-month study we had 10 mini-lessons, which exposed the students to a great variety of writing styles. I found these lessons had a positive impact on the students' writing as they tried different styles in their science learning journals; as well, the lessons gave them a good understanding of how to effectively use their journals.

Focus Children of the Study

The following is a brief description of the personality and personal journal writing of each of the five focus children in this study. In the students' personal journals, Mary encouraged the children to choose their topic, use inventive spelling, help each other and find words provided on bulletin boards around the room. It is hoped that information on the children's personalities and personal journal writing will provide some background and context for the students' oral, drawn, and written responses in their science learning journals which are analyzed in the following chapter.

Steven

Steven was a very talkative, sociable 6-year-old who loved to share his writing and ideas with others. During my visits, Steven was very cooperative and openly shared his thoughts about his work with me.

At the beginning of this study, Mary expressed her concern that Steven believed a line of letters could be a sentence, a thought, or sometimes could represent just one word in his personal journal writing. On closer observation, I noticed that Steven orally told his stories while writing and would relate them to comments he heard made in group discussions or in play situations. Steven often created dialogue between his characters for his own pleasure and that

of his friends. The other children at his table would get involved by asking questions and making suggestions. The following is an example of the discussion that surrounded the creation of one journal entry:

Steven: She never cuts her nails, they keep on growing and growing.

Kathy: She should cut them to there.

Steven: She never cuts them. She doesn't have any fingernail clippers, she wasted all of them by throwing them into the pot. This is the Headless Horseman coming to the rescue. A witch with long fingernails is waiting to cut him . . . to turn him into a statue. (wiggling his fingers at Kathy.)

Kathy: The people are saying "Watch it."

Steven: Ya. The bat is saying, "Watch it, watch it." The cat is saying, "Watch it, watch it." The bat is saying, "Watch it, watch it, you nearly bumped my wings." "Watch it, watch it." Points to each character and changes voice for dialogue.) This time she will have eyebrows. She is going to live forever. Witch, witch. I'm going to draw the Headless Horseman. Headless Horseman and witch, witch. (Changes voice into a cackling witch) The witch, ha, ha, ha. Now to put some magic. Magic. (Turns to Karla) Do you know what this is?

Karla: No.

Steven: She shrunk him. Now he is small. (Changes to witch voice) Smaller, smaller. Magic, magic everywhere. I'll show you. Ha, ha, ha. Mean witch. Magic brew, the magic of the brew. Ha, ha. The magic brew, the magic brew, brrrewwwww. The magic, the

magic. (Changes voice back to his own and reads entry) This is the Headless Horseman, Karla, and he is small. See him?

The actual act of writing for Steven appeared not to be important. He managed to remember his stories by his many tellings to his friends and through his drawing. Steven did, however, continue his stories over a number of days, always adding new twists to his stories. He appeared to enjoy his personal journal writing time and often chose to write in his free time.

Figure 1. Excerpt from Steven's personal journal

Eve

Eve was a cooperative 6-year-old who enjoyed taking on a leadership role during assigned small group activities. However, she was a very quiet worker who rarely talked to others at her table.

Mary stated that it appeared that writing came easily to Eve even though she struggled with reading. Mary also was trying to encourage Eve to work cooperatively instead of always taking charge when working with others.

Eve worked carefully but steadily on her journal entries. Her drawings were detailed and her writing revolved around personal events and interests. When Eve wrote in her personal journal, she would just barely whisper to herself as she re-read her writing. I was not able to get an audible tape of this self-talk while writing. As Eve wrote she ignored all the distractions around her. She also chose to write in her free time.

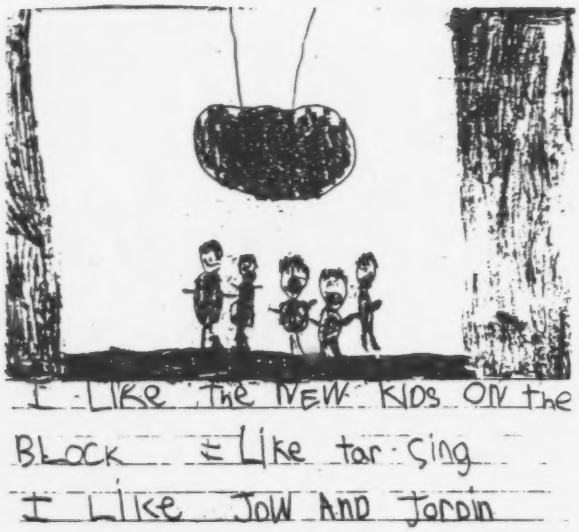

Figure 2. Excerpt from Eve's personal journal.

Michael

Michael, a twin, was a polite, cooperative 6-year-old. His twin sister loved to write, whereas writing didn't come easily to Michael. Mary felt he was of average ability in all areas but noted that he would work diligently for up to a half-hour to complete only a sentence or two.

I observed Michael during personal journal writing. He worked slowly and carefully to draw detailed pictures in his journal. He would explain his drawings to himself and his friends. Michael wrote about personal events and adventure stories.

> Michael: I'm drawing it right now. See, it has lots of seats. It's a big one. Even my Dad could fit on it and my Mom.

Colin: And you.

Michael: Yup. Because it was my brother's party and the whole party could fit in it.

His family members were usually the main characters in the stories.

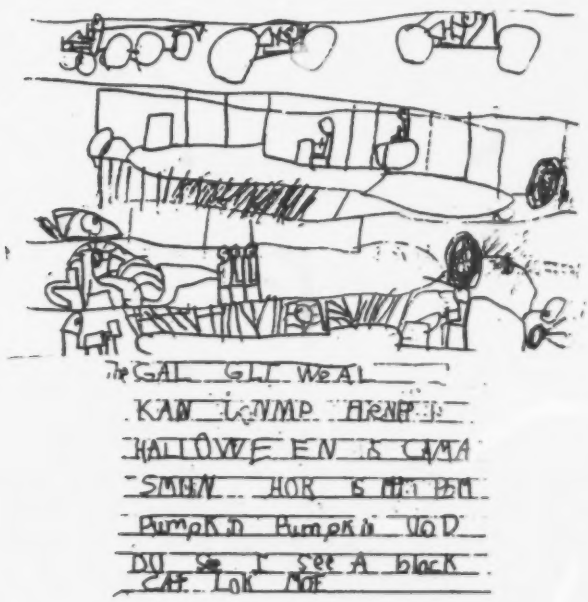

Figure 3: Excerpt from Michael's personal journal.

Dawn

Dawn was an outgoing, cheerful 6-year-old who found it difficult to sit still; her body was always in motion. She seemed to be able to follow directions and stay on task while she wiggled in her chair.

Mary stated that Dawn's personal journal entries were short and very repetitive in that she wrote about one idea or event a number of times. Mary tried to encourage Dawn to choose new topics and writing styles with little success.

While Dawn wrote she would often sing or talk to herself and the others at her table.

> Dawn: Blue. Ba-lue, ba-lue, ba-lue, ba-lue, ba-lue (singing). Ba-lue, ba-lue, ba-lue, ba-lue, ba-lue. Good morning, this is Q.S.T.V. Edmonton by wide Edmonton waters (humming). Yellow (singing). I was so, Y was so, ya was so (singing voice). La ba, so, do, yellow, doe, doe, doe . . .

She would also frequently re-read what she had written.

Figure 4: Excerpt from Dawn's personal journal.

Thomas

Thomas was a shy, quiet 6-year-old who sat next to Steven. In his personal journal he wrote mainly about personal events through the use of patterned writing. He would quietly talk himself through his writing, thinking about what he would like to write, rehearsing what should be written, and searching out spellings from bulletin boards, previous journal entries, or from his knowledge of phonetic spelling.

> Thomas: I'm just going to be Nov. . . . v. . . v. . . v. . . (gets up and walks to the calendar to find the word November). It's v. . . e. . . m. . . (looks at calendar) . . . b. . . e. . . (looks at calendar) and one more r. November. November 6th. By Thomas, period. Put that there. November 6th. Let's do this again (erases his name and adds 1991). November the 6th, 1991. Done. I'm a b. . . b. . . b. . . b. . . r. . . e. . . v. . . I'm at Beavers. It is . . . (writes "fun"). It r. . . r. . . r. . . round, round, round. "H". . . I am be. . . (mumbles story to himself). (Looks on wall for a word and copies it.) F. . . f. . . f. . . f. . . f. . . a right at c. . . c. . . t. . . t. . . at . . . f. . . s. . . s. . . s. . . d. . . d. . . d (reads story over to himself). (Seems deep in thought.) I. . . it. . . it is fun.

Thomas was very conscious of audience and knew that stories need structure in order to make sense. He would often insist that his friends' journal entries should make sense too.

> Steven: Thomas, Thomas, the nasty witch is back again.
>
> Thomas: I thought she died.
>
> Steven: I don't control the witch.
>
> Thomas: You must know. You control the witch, it's your story.

Steven: She made a magic spell. She must have made a magic spell before she died.

Thomas: Didn't the Headless Horseman kill her?

Steven: No.

Thomas: What happened then, if the Headless Horseman didn't kill her?

Steven: I don't know.

Thomas: You must know 'cause you're making the story.

Steven: She came back to life.

Thomas: How and when?

Steven: She made a magic spell before she died.

Thomas: And?

Mary had commented on how Thomas would not venture from his predictable journal writing. Mary had tried to move Thomas, like Dawn, away from patterned writing and had encouraged him to try other styles.

NOVEMBER 6 [illegible]
I-M-A-T Bcfs it IS FUN I Like
Bcfs I R[illegible] Bcfs Bcfs is one
OF MY FAFRT AC TIS A TIVS I DO
IT IS FUN

Figure 5: Excerpt from Thomas' personal journal.

Chapter 5
TALKING TO LEARN:
PRESENTATION AND DISCUSSION OF DATA

This chapter will present and discuss the data collected during this study. It will focus on the children's talk during both the experiments they did and during their writing.

Talk

The goal of the Alberta Science Curriculum (1983) is "to encourage and stimulate children's natural curiosity through exploration and discovery while emphasizing the communication skills to express their ideas and learn from others" (p. 1). Therefore it was vital to provide time for the children to talk so that they could share their observations, ideas and thoughts. This was the rationale behind having the children work in pairs on the science experiments.

Britton (1970) stated that talk plays a crucial role in problem solving and learning. He believes we should give children time to talk about events and experiences. By allowing children the opportunity to discuss their observations and thoughts we give them the means to shape those new events, through their own language, so that the events become more accessible to the children's learning process.

When talking to other children about the new events the child is using her own language to make sense of the new experience by finding ways to "integrate new knowledge with old knowledge. As children talk about new experiences they don't merely add new knowledge: what they already know

changes" (Dudley-Marling and Searle, 1991, p. 60). Barnes (1976) stated that it is important for the teacher to remember to allow the students to use their own language to make meaning and not to expect the students to use subject language. "If students cannot use their language to construct their own understandings, then developing life-long learning will be that much more difficult" (Dudley-Marling and Searle, p. 61).

Talk During Experiments

It is through language that we shape our experiences, share our thoughts and ideas (Britton, 1970). Therefore it is natural for children to use talk in all areas of the curriculum, especially science, where the children are trying to understand the world they live in. Children at this age are naturally curious and are interested in talking about what they are doing or have recently done. I felt it was important to record the talk of the focus children as they worked with their partners. The analysis of the data suggested that the children used talk for five purposes: (a) to focus attention, (b) to add information, (c) to negotiate meaning, (d) to build community, and (e) to problem solve.

Focusing Attention

Lindfors (1987) stated that "children's talk serves to help them attend to and execute tasks" (p. 265). This was true of the focus children in this study. Michael and his partner Colin, an E.S.L. student, worked and played well together. They used their talk to focus one another's attention on certain aspects of what they were doing or observing during an experiment.

Michael: Looks like tea. Looks like tea.

Colin: It's coming out! See.

Michael: Ya-a-a. It smells like tea.

Mrs. O: Talk about what you see with your friend.

(Whispering--inaudible)

Michael: Smell it! It smells like tea. Watch the lines. They're swirling.

(Pause)

Colin: They're all gone. The lines are gone.

Michael: Ya. There is barely anything left.

Colin: It's all gone.

Michael: Looks like we don't have any more.

Colin: Look from the side.

Michael: It's all gone. There is little holes in the bag.

(Inaudible)

Colin: See the bag.

Michael: See the holes.

(Audiotape transcript, Feb. 26, 1992)

During this experiment the boys were observing sugar, which was in a tea bag, dissolve in hot water. Michael and Colin were taking turns drawing each other's attention to an

observation they had made by saying "smell it", "watch the lines", and "look from the side". I encouraged this type of discourse by reminding the children to talk about what they saw with their partner. The boys' remarks enabled them to explore the same aspect of the experiment together. By focusing each other's attention, they were able to observe more during an experiment than they may have done on their own. In the Vygotskian perspective, they were taking turns extending each others' learning. Michael and Colin were providing a scaffold (Bruner, 1986) for each other on which to build their science knowledge. Cazden (1988) stated that "scaffold refers to the temporary and adjustable help" (p. 8). This was true with Michael and Colin as the help swung like a pendulum between them.

Eve and Danny, a child who was retained for a second year in Grade 1, also used their talk to focus each others' attention on an aspect of an experiment.

Danny: Looks like a storm.

Eve: Looks like smoke.

Danny: Ya.

Eve: It looks like waves. Don't touch it like that! Oh, look!

Danny: See the steam?

Eve: Can you hear it?

Danny: No.

Eve: It's getting closer.

Danny: Oh, boy! Oh, boy!

Eve: It looks like hair. Maybe. . . maybe the bag has holes. That's why it gets out. Maybe. . . maybe. . .

Danny: Maybe.

Eve: It makes it salt water.

(Audiotape transcript, Feb. 25, 1992)

Eve also makes predictions as to why the salt was leaving the tea bag. Danny confirms that it could be a possibility. Eve then makes another prediction that "It makes it salt water." Danny later suggested that they taste the water to check. This experiment and dialogue led Eve and Danny to pursue their personal interests. At the same time they were learning and carrying out the scientific methods of inquiry. "The students were also able to keep the experience close to their own understanding because they were able to use their own language to direct the inquiry" (Dudley-Marling and Searle, 1991, p. 68).

Adding Information

Booth and Thornley-Hall (1991) believed that children who have the opportunity to discuss their thoughts, observations and ideas will benefit from the other children participating in the discussion. All the children's learning will be extended through the discourse.

Michael: Three things, seeds can make popcorn and yellow. . .

Colin: They're a little bit pointed.

Michael: . . . and white and has a point at the top. It's kinda brownish, too.

Colin: It's yellow and white, pointy. . .

Michael: It's an oval shape. O-o-val.

(Audiotape transcript, Jan. 14, 1992)

Thomas: I'm going to use yellow for the grass because that's what it changes from the weather. Okay? What do you want to do, Karla?

Karla: Weather change.

Thomas: Okay. The w-w-w-weather -r-r-r. How does that change?'

Karla: Sometimes it's sunny. . . sometimes it's rainy.

Thomas: Okay. Sometimes it's sunny and sometimes it's rainy. . . or snowy.

Steven: Sometimes it's cloudy and cool.

(Audiotape transcript, Jan. 8, 1992)

In these two examples, the children are adding to the previous information. Michael and Colin are adding to each other's observations of a popcorn seed. Steven, Thomas and Karla, a very quiet student, discuss their understanding of weather, which expands each one's knowledge and definition.

Britton (1967) believed that fostering talk about an experience or event leads students to become both more aware and more articulate. In these examples, the children were searching and experimenting with the language, adding on to

each other's ideas and attempting to be more observant and articulate.

Negotiating Meaning

Barnes (1976) believed that when children are discussing observations, ideas and thoughts they are doing more than adding on to each other's ideas. He stated that:

> In dialogue speakers take up statements that have gone before and develop them: one adds a qualifying condition, another suggests a cause or a result, another negates the whole statement, another reformulates it, and another qualifies one of the objects which it refers to" (p. 90)

Jane: Dogs change.

Colin: Cats change.

Michael: No!

Jane: Ya, because they are all different.

Michael: Ya, but they don't change!

Jane: But they are different.

Michael: Well, puppies change.

Jane: Puppies change?

Michael: Ya, puppies change into dogs.

Jane: Okay, I'll write it down.

(Audiotape transcript, Jan. 8, 1992)

Here, Michael, Colin and Jane struggle to negotiate whether animals change. Jane attempts to explain her reasoning for her choice of "dogs" for the change chart they were working on. She had difficulty verbalizing her reasoning but Michael picked up on Jane's idea and explained what he felt she had tried to explain. They all agreed on the explanation and "dogs" was then added to their chart.

Dawn: This isn't as heavy any more! (referring to a solid bag)

Bob: It smells hot.

Dawn: I can't smell. It's going away.

Bob: Everything's gone. Everything. . . everything dissolves in here!

Dawn: Not a pencil!

Bob: Ya!

Dawn: Look at it! (sticks in a pencil)

Bob: Oh. . .

(Audiotape transcript, Feb. 26, 1992)

In this example Dawn and Bob, an average student, have a disagreement over whether hot water can dissolve everything. Dawn needed to convince Bob that his generalization about hot water was a misconception. She accomplished this by carrying out a quick experiment to demonstrate her point to Bob. Long and Bulgarella (1985) state that this type of "interaction is desirable because it leads to clashes of point of view" (p. 171) which encourage children to support their ideas. "When

children try to convince others of the superiority of their own ideas, they have to decenter and think about an issue from someone else's point of view as well as their own" (p. 171) which encourages the development of individuality and creative thinking.

Building Community

In a community of learners, children listen, question, challenge, share and take risks. Barnes (1976) and Britton (1970) believed that when children engage in these activities, they contribute to each other's learning. In a positive classroom community, everyone becomes both the teacher and the learner (Calkins, 1986). In this study, the children built their learning community through organization of tasks, reviewing rules and instructions for their partners, and affirming observations.

The science experiments for this study were either guided experiments, which had a number of steps to follow, or individual inquiries in which the students designed the steps. I noticed that all the students spent time on designating jobs or steps for each experiment.

> Michael: One of us hold the solid bag and the other the cup.
>
> Colin: You hold the solid bag and I'll hold the cup.
>
> Michael: I know. Then we will change. Hold the cup at the top so when she pours the water in, it won't spill.
>
> Colin: Okay.
>
> (Audiotape transcript, Feb. 16, 1992)

This type of discourse enabled the children to work as a team to complete their experiment. All the children became very good at assigning jobs and made sure everyone got equal turns. Dudley-Marling and Searle (1991) state that a learning community is based on mutual support and cooperation which is conducive to a good learning environment.

Repeating questions, instructions and science rules was another way the students offered each other support and built community.

> Danny: You can smell like this, Eve, because it's not like the other stuff we use.
>
> Eve: You can. . .
>
> Danny: And you can taste. . . like. . . because it's safe.
>
> (Audiotape transcript, Feb. 25, 1992)

In this example, Eve had not heard me tell the class that the solid we used in this experiment was safe. Danny repeated this information to Eve; as well, he reminded her that the safety rule about not smelling a substance was not necessary. Dyson (1983) stated that children learn to rely on their peers' expertise to assist their learning.

The students seemed to need their observations and thoughts affirmed by their partners as they worked on the experiment.

> Michael: Tastes salty. Looks like sugar. Don't you think?
>
> (Audiotape transcript, Feb. 25, 1992)

Usually, a student like Michael would make an observation, then follow it with a question such as: "Right?",

"See?", and "Don't you think?" The partner would typically respond with a nod or a "Ya." The children offered support to one another and reinforced the fact that they had something important to say and that there was someone who would listen.

Rosen and Rosen (1973) believed that students' organization, repeating information and affirming observations "serves to not only teach children about others and how to live with them, but, as it knits groups of children together, it makes new kinds of communication and learning possible" (p. 43). A positive learning community also made the students more independent and actively involved in their own learning.

Problem Solving

Britton (1990) stated that we use talk to solve problems and to learn. He found that children were able to solve problems jointly by talking their way through them. I found the focus students of this study did the same thing.

> Michael: Come on, seed.
>
> Danny: Michael, you dropped your seed.
>
> Thomas: You know what's a better idea? Use two instead of one because if one falls you have one and. . . ummm . . . if you have one only the one can pop and if you have two you have twice the chance. You need two for them to pop.
>
> (Audiotape transcript, Jan. 15, 1992)

In this situation the students had wondered if they could produce enough heat through friction to pop a popcorn seed. Michael's seed kept falling out of his hands so Thomas offered him a solution and his reason for the suggestion. The solution was based on prior knowledge. This seemed to be the most

common way for the children to solve any problems that arose. The students were constantly applying their previous knowledge to their problems or observations.

Dawn: That's steam. That means it's hot.

(Audiotape transcript, Feb. 26, 1992)

Britton (1990) stated, "It is language of their own intimate musings, their inner reflections upon experience, that will serve both to bring their common-sense concept to the point of engagement with the scientific concept" (p. 107) which leads them to make sense or solve a problem in an experience.

I have tried to give examples of the recurring themes in the focus children's talk; however, these aspects of their talk didn't happen in isolation. They were all present, in some form, as the children engaged in conversation with each other.

Eve: Oh, it's turning into sand.

Danny: Oh, wow!

Eve: Or maybe coffee.

Danny: Could be coffee.

Eve: You guys watch your's.

Danny: Wow! It's turning yellow.

Eve: Maybe tea.

Danny: Ya, because it's yellow and a little brown.

Eve: Ya. Kinda. You know, I think tea is made with pepper.

Danny: Oh, no, I think I drink tea sometimes.

Eve: Oh, great!

Danny: Oh, my God!

Eve: We have to get the stuff out. Get out, get out, get out.

Danny: Ours might stay in, you know.

Eve: It smells yukky.

Danny: Smells salty.

(Eve smells and sneezes.)

Danny: Why would we ever pick pepper?

Eve: You guys watch your own. Ours might turn into tea.

Danny: Salty tea.

Eve: It sorta smells like cinnamon.

Danny: Ya.

Eve: Smells like salt to me.

Danny: I smell a little cinnamon.

Eve: Uh-oh, we're dripping!

Danny: Here.

Eve: Stay, stay, stay. . .

Danny: That was loud.

Eve: Okay.

Danny: Bong, bong, bong. Looks like sand, right?

Eve: Right. And it's hot. (laughs)

Danny: It's h-o-o-o-t! Okay. Bong, bong, bong. (bouncing solid bag in the water)

Eve: The water is turning yellowy-orange.

Danny: It looks like tea.

Eve: Yup! It might taste good. Look at this. The pepper is kind of turning white. Did you know that our tea bag might not let the pepper out?

(Audiotape transcript, Feb. 26, 1992)

In this example, Eve and Danny were focusing each other's attention by verbalizing their observations and predictions. They affirmed each other's ideas and thoughts with "Yup"s and would add on information to the statements they had just agreed with. Vygotsky (1978) states that learning is social, and in this study the children's talk reflected the learning and thinking that was taking place.

Talk During Writing

Researchers (Calkins, 1991; Long and Bulgarella, 1985; Graves, 1983; Dyson, 1983) believe that teachers should encourage and provide opportunities for children to talk to one another during the various stages of writing. Britton (1970) stated that interaction with others enabled the children to

recall, analyze and organize events in a meaningful way. It is "because the children talk with peers and the teacher about matters before writing they are not overwhelmed by their task" (Britton, 1982, p. 113).

Dyson's (1983) study indicated that children's talk during writing served two purposes: to assist in organizing thoughts in order to get them on paper and to seek information on spelling, directions, etc. Graves' (1983) work supports this premise and he stated that talk is very important as it is part of the composing process. "Oral language contributes to the act of writing, it becomes a powerful learning strategy that stretches writers in ways they cannot accomplish in isolation or in silence" (Kasten, 1990, p. 155).

Talk Before Writing

In this study the children were given time to discuss with a friend what they did in the experiment, and what they learned, before starting to write in their science learning journals.

> Dawn: I'll go first. I heard a roar. I smelt popcorn. I heard something popping and I smelt something. No. What did you smell?
>
> (Audiotape transcript, Jan. 14, 1992)

The children had just finished a guided inquiry experiment and were discussing the experiment with each other. Dawn and Bob decided they would take turns, so Dawn started telling Bob what she had remembered about the experiment and then became unsure of just how to describe what she had smelt. This discussion helped Dawn realize that

she needed some information before she could write in her journal, and Bob could help her.

Michael: You go first.

Colin: Well, I smelt the popcorn when it was in the machine.

Michael: Yes.

Colin: Then, I saw the popcorn. It was yellow and it popped out of the machine.

Michael: You forgot something. You forgot that before she took the popcorn machine out, we got a piece of popcorn out.

Colin: Before she took the machine out, ya!

Michael: First we looked at it and smelt it.

Colin: Then she got the machine out.

Michael: Then she put the popcorn in the cup and poured it into the machine.

Colin: What?

Michael: Then popcorn came up.

(Audiotape transcript, Jan. 13, 1992)

Kasten (1990) stated that when children are involved in evaluating pre-writing ideas and written work in a positive way the idea of community of learners is fostered and the children are able to support and encourage one another.

Eve: I'm going to write that the pepper didn't come out of the bag but just a little bit came out and it went to the bottom and it turned color.

Danny: Okay, my turn. I'm going to put that a little bit of pepper came out . . . and a little bit came out and when it did that it went all over the place. (Starts writing.) I like this kinda science!

(Audiotape transcript, Feb. 26, 1992)

In this example Eve and Danny, like Michael and Colin, feel free to share their ideas with each other. The children know that this is a safe learning environment which allows them to exchange and expand on each others' ideas. The children knew they all still had the freedom to choose which ideas they would use for their writing; however, they benefited by exchanging ideas and suggestions.

Talk During Journal Writing

While Dawn wrote she was in constant motion and talked to herself. She wasn't distracted by the other children and would ask them questions such as "I don't know what to write," but she didn't wait for or need an answer from her peers.

Dawn: So, so, so. . . (humming) (Pause--teacher walks by) I don't know what to write. (pause) I can write myself. I. . . h, h, h. . . (pause) ch, ch, ch, ch. . . (erasing) (Silence) I have an egg. Okay. And. . . the. . . (growls) d, w, w, w. . . (growls). And the egg is r-r-r and . . . the . . . (moves jar) (Sigh) And my egg smells like cheese. And. . . my. . . egg. . . egg. . . And my egg. And my egg is rough and sm, sm, sm-a. It smells. And my egg smells like. . . ch-ch-ch-ch-ch-ch-ch. My egg smells like. . . (moves jar). I can't move my egg or it will break. I don't have anything to do my. . . umm. . . do my. . . you

> know. You can smell the cheese. Cheese. I had cheese this morning. I had a egg. And the egg is big. And the egg rough. An my egg smells like cheese because of cheese and the. . . and the cheese. . . smells like. . . smells like. . . cheese. There! Cheese, cheese, cheese. (Sigh) Cheese and. . . I'm almost to the end.
>
> (Audiotape transcript, Jan. 14, 1992)

Here Dawn's talk served to assist her writing and decoding, and kept her on task. Tough (1977) stated it's a way for a child to be "aware of the actions [she] is performing" (p. 47). Lindfors (1987) believed that "this action-related use of language [is] an important aid to [her] comprehending and learning" (p. 266).

Steven, Thomas and Michael also dialogued with themselves, in a similar fashion to Dawn, while they wrote.

> Michael: Pickling salt. . . like. . . it looks like. . . some. . . some. . . taste. . . sal. . . salty. It is white.
>
> Jane: I'm putting that down, too.
>
> Michael: I. . . white. . . it's sugary. . . it tastes salty and it's white. It. . .
>
> Jane: How much are you writing?
>
> Michael: Sh-h-h.
>
> (Audiotape transcript, Feb. 26, 1992)

By Michael talking to himself he not only focused his own attention but that of Jane's. Jane wanted to discuss their journal writing but it was very obvious that Michael, like Dawn, was very focused and wanted to work alone. Lindfors

(1987) stated "that the very act of verbalizing helps us block out distractions and focus our attention on a demanding task" (p. 268).

Britton (1975) stated that "language is one way of representing experience . . . we habitually use talk to go back over events and interpret them, make sense of them in a way that they were unable to while they were taking place" (p. 19).

Steven: What are you drawing a picture of?

Thomas: A box of ice.

Steven: Oh.

Thomas: Remember, that big chunk of ice we had?

Steven: Ya, it was big!

Thomas: I'm going to make ice cream when I get home.

Steven: Vanilla.

Thomas: I know how to make vanilla. Use white milk.

Steven: How do you make chocolate again?

(Audiotape transcript, Jan. 28, 1992)

Here Michael's and Steven's language was serving as an aid in making better sense of their past experience. The boys reviewed the experiment and Michael applied the knowledge he learned from the chocolate ice cream experiment to the making of vanilla ice cream. Steven got Michael to go over the experiment with him.

So by talking to one another about our past experiences we are able to "isolate it, consider it, reinterpret it in light of

our ever changing and growing "theory of the world in the head" (Lindfors, 1987, p. 169). Hence language is the means for our understanding and our learning, for making sense out of our past experiences (Britton, 1990).

Dyson (1983) stated that while writing "oral language was a tool for seeking needed information, assisting self in encoding and decoding" (p. 17). The focus children in this study asked each other for spelling, directions and definitions of words.

Scott: Change. Ch, ch, ch. . . How do you spell "change"?

Thomas: Just look up there.

Scott: Where?

Thomas: Over there. (pointing to the word)

(Audiotape transcript, Feb. 13, 1992)

Dawn: Do I start here?

Eve: Look how much I've already done!

Dawn: Oh.

Eve: Start there. (pointing)

(Audiotape transcript, Jan. 14, 1992)

Eve: What does "dissolve" mean?

Danny: It disappears.

Eve: It doesn't disappear. Ours didn't because it stayed in the bag. So it didn't dissolve.

Danny: A little bit.

(Audiotape transcript, Feb. 26, 1992)

By talking to their peers, the children were able to have their classmates help them with the difficult task of encoding their messages. The children knew they were not alone when writing and that they need not get frustrated as there was always someone that could help.

Talk While Sharing Journals

When the children were finished their journals, they would read their entries to a friend or to me. The children seemed to enjoy reading their science learning journals to someone else.

Michael: I'm coloring.

Colin: I'm finished my question so I can color.

Michael: I'm making jello because I love how solid made jello. Jello. . .

Colin: We eat the jello.

Michael: We ate the jello. See, the apple is too big and the orange is too small. I like it. Chris liked it, too. The solid made the apple juice turn into jello. That's it.

Colin: Do you want me to read my journal?

(Audiotape transcript, Feb. 25, 1992)

They would take turns listening to each other's science learning journals and toward the end of the study, the students were becoming aware of an audience. They would, like Steven, ask each other if they needed to add any information to their science learning journals.

> Steven: Did I miss anything? (Pause) Did I miss anything, Karla?
>
> Karla: The popcorn started popping when we put it in the popper. It floated up. It was popping.
>
> Steven: It's popping up because it's hot and it's popping.
>
> (Audiotape transcript, Jan. 14, 1992)

The other child would often make suggestions that could be added to the reader's entry. Some of the mini-lessons I taught focused on responding to their peers' science learning journal entries.

The children then began to give positive feedback to their partners' writing by picking out sentences or ideas that were in the entry.

> Steven: Wow, you can really write, Karla! I can't believe you! That was amazing how Karla writed. I didn't know you could write that good.
>
> Karla: Thanks. Your turn.
>
> Steven: I just can't believe it. That is amazing. One, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen. . . thirteen lines. Wo-o-o-o-o!
>
> Karla: (She recounts)

Steven: You should be proud of yourself, Karla.

(Audiotape transcript, Jan. 14, 1992)

Steven has just listened to Karla's entry and attempted to respond positively to her writing. He commented on the amount. This example is from early in the study. Steven still hadn't fully understood how and to what he should respond in Karla's writing, but he made an attempt that made Karla feel proud of her work. In addition, this kind of interaction with each other really added to the positive learning environment in the classroom.

Summary

In this study, talk was present during experiments and through the various writing stages. The talk served different purposes depending on the situation. During experiments, the children used talk to focus their attention, add information, negotiate meaning and solve problems. During writing the children talked in order to interpret, organize and make sense of their experiences. The students assisted each other by providing spelling directions and information. Overall, the children's talk served to build a strong learning community as they interacted positively with each other.

Watts (1980) stated that it is very important for children to have the opportunities to explore science experiences and ideas using their own language. He believes that using language the children understand and feel comfortable with assists their learning of new science concepts. The data in this study supported his belief. The children were actively involved in socially constructing their own meaning through the discussions with their peers (Bruner, 1986; Vygotsky, 1978).

All the children in this study used their discussions to "talk themselves into a better understanding" (Barnes, 1976, p. 61). They added to their own knowledge through dialogue with others.

In my interviews with the children, they enjoyed the opportunity to talk about what they were doing and learning. Steven said that it was easier to work and talk with a friend "because you don't forget stuff." Dawn felt it was important to work together in experiments as "some people might not know what to do." As Eve said, "We can do it together and help each other." Michael also enjoyed having a partner during the science experiments "because sometimes they give you questions that you could think of." Lindfors (1987) would agree as she stated "it is often in interaction with others that a child encounters the new idea, cognitive conflict and support" (p. 283).

When I asked the students if they enjoyed being able to talk to a friend while they wrote, they all felt it helped because "then you can get ideas from your friends and you don't have to think of all the ideas yourself" (Thomas, Feb. 28). Michael stated that you "find out what the other person did and learned", plus "they help you spell words."

The children were able to verbalize that working and talking with a friend helped them organize their ideas and consider other possibilities. I noticed that they all willingly interacted with each other and took risks, which denoted that they felt they were in a safe enough environment to take risks, and learn from and with each other.

I felt that the results from this study illustrate Vygotsky's (1978) point that learning is social. We talk ourselves into better understandings or to gain new insights. Britton (1970) feels we can help each other's learning by

talking. These children's interactions were of great importance to them in making connections, learning new concepts and changing and expanding their knowledge of their world. They knew they were not learning in isolation but had the comfort and support of their peers.

Chapter 6
SCIENCE LEARNING JOURNALS: PRESENTATION AND DISCUSSION OF DATA

This chapter will present and discuss the data collected during this study. It will focus on the children's drawing and accompanying writing in their science learning journals.

Drawings

At the end of each experiment, the students were given time to respond to their hands-on experience by drawing and writing in the science learning journal. MacAlister, Kydd and Jones (1991) stated that often the young children's drawings showed the children's understanding of a concept more clearly than their written work. Barnes (1992) stated that "when children draw from the experience of looking" (p. 47) or doing, they often draw with more detail. This was true of the children's early work in this study. I had encouraged the children to use as much detail as possible. I had explained that this is one of the ways a real scientist records her experiment.

At the beginning of this study, Steven and Michael found writing very difficult. Steven's writing consisted of lines of letters and Michael struggled over deciding which letter corresponded to which sound. Both these boys are very verbal and their drawings reflected their understanding or how they viewed an experiment. Michael and Steven spent the majority of their journal time on their pictures.

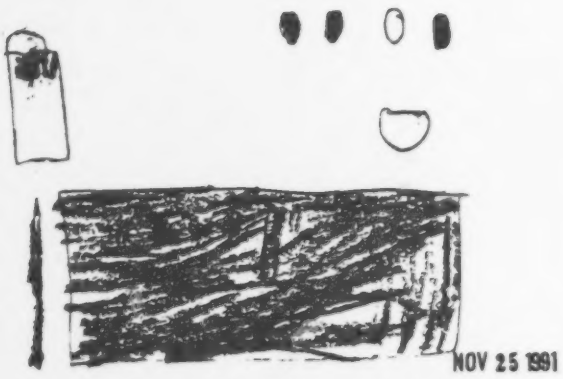

Figure 6: Example of Steven's early drawings.

In this journal entry, Steven had recorded the equipment and results he had obtained from his primary color mixing experiment. Steven included his name on his page. He had colored three of his dots orange, purple and green. When I asked Steven to read his entry to me, he told me it said, "I mixed colors, primary colors. I like to mix colors. I really like to do science." He then elaborated on his journal entry by explaining what primary colors were and how he made the secondary colors. Steven was able to articulate and illustrate clearly what he learned. Lowenfeld and Brittain (1982) agreed and stated that children's drawings are a "tangible record of [their] thinking process" (p. 205). However, if one had focused only on Steven's written work one might assess that he didn't have much understanding of the concept taught.

Michael struggled with his personal journal but stated he enjoyed working in his science learning journal. Michael's drawings, like Steven's, held most of his knowledge about what he had learned.

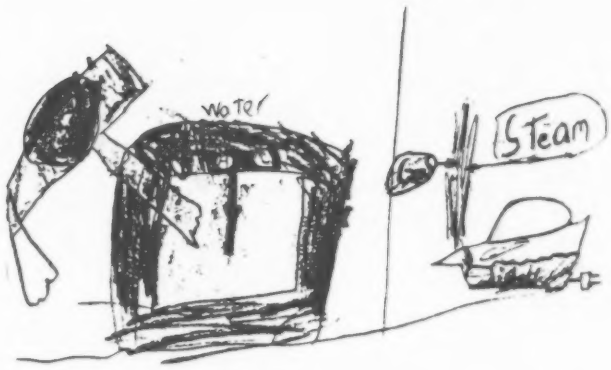

Figure 7: Example of Michael's drawings.

This entry was in response to a personal inquiry of "I wonder if water will change with heat?" Michael's written answer, "Because the water is cold and the steam is hot" doesn't offer much insight into his understanding of what happened in the experiment and why. His drawing, however, lets the reader see what he did and shows the results of his experiment.

In the first frame of Michael's drawing he drew a picture looking down on himself running cold water. The next frame shows that he put the water into a tea kettle; the water, which is a liquid, turned into steam, which is a gas. Michael had done an excellent job of illustrating his learning. The reader can quickly determine that Michael had internalized a number of science concepts.

Michael experimented with a number of different ways to illustrate what he had learned. He tried labels. . .

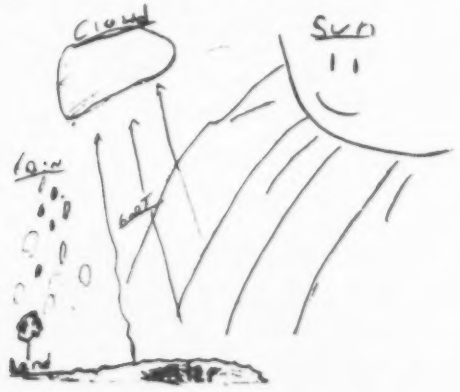

Figure 8: Michael's labeled drawing.

drew steps. . .

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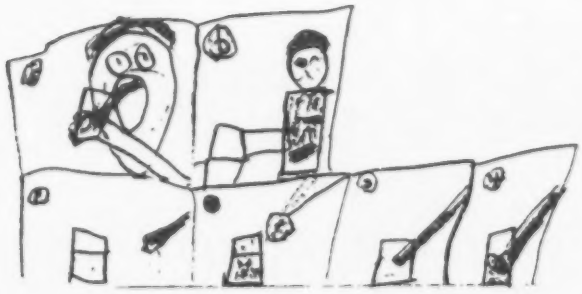

Figure 9: Michael's step drawing.

and added conversation.

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Figure 10: Michael's drawing with speech bubbles.

It's also interesting to note that because Michael would share his entries with other children, they too began to try different styles. For example, Steven drew himself enjoying making lemonade.

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Figure 11: Steven's lemonade entry.

Thomas used Michael's labelling idea for his entry describing his observations of an experiment dealing with change.

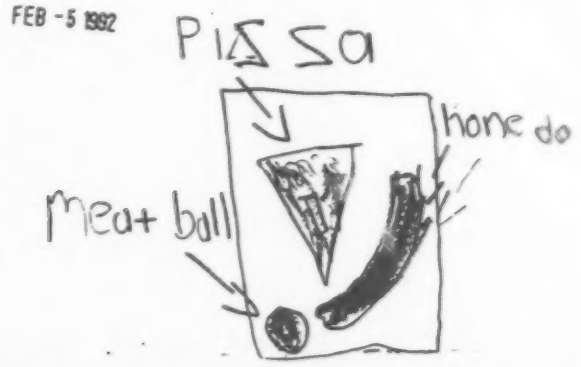

Figure 12: Thomas' labeled drawing.

Some of the children in the study drew more than just the equipment that was used; some, like Danny, included what was written in English and French on their crayon boxes. . .

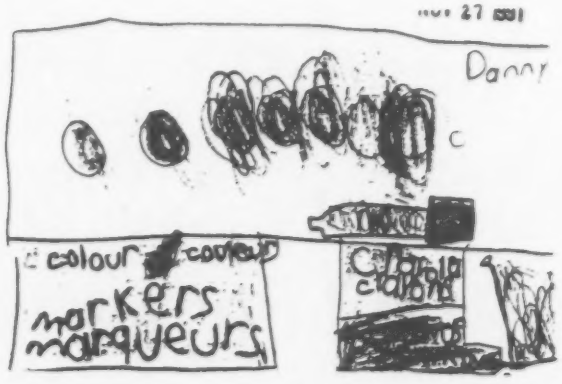

Figure 13: Danny's detailed drawing.

or what was written on the blackboard.

Figure 14: Danny's second detailed drawing.

Eve and Thomas started their science journal entries with detailed drawings, as did Michael and Steven. However, as the study progressed and their writing skills improved, they included less-detailed drawing and more writing.

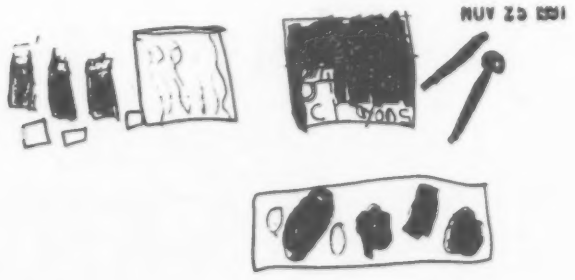

Figure 15: Thomas' early drawings.

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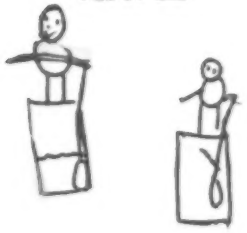

Figure 16: Thomas' later drawings.

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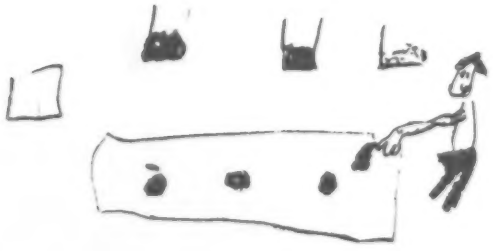

Figure 17: Eve's early drawings.

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Figure 18: Eve's later drawings.

Dawn's drawings were consistent throughout the study. They contained some detail; however, she relied heavily on her written work to convey her learning.

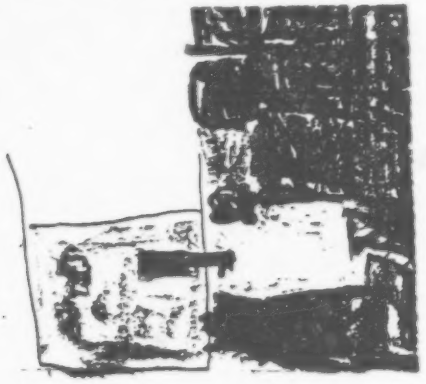


Figure 19: Example of Dawn's drawing.

In this entry, Dawn described her observations of the pickling salt, the steps she took in the experiment, and the result. The reader would not grasp all this information from her drawings.

I feel that Dawn didn't put detail into her illustrations for two reasons: she tended to be in a hurry, so worked quickly; and, she enjoyed and had success with writing. I had noticed that two other children in the classroom with the same type of journal entries as Dawn also worked quickly and wrote well.

Summary

At the beginning of this study, all the children's science learning journal entries contained detailed drawings. How these drawings changed or progressed over the course of the study seemed to depend on the student's writing ability. Students such as Steven and Michael, who struggled with writing, put more effort into their drawings and wrote less. If the students writing skills were improving, as were Thomas'

and Eve's, they gradually moved towards longer, more detailed written work and less detailed drawings. Students such as Dawn who worked quickly and felt comfortable with writing tended to draw detailed illustrations only when reminded by a classmate or by me. MacAlister's et al. (1991) study results indicated that "Drawing is an important stage of development when recording information. This is followed by increased attempts to write" (p. 9). Dyson (1987) also stated that drawing is the first step in composing. This study's data supported those findings. The children needed to start recording their ideas and learning through their drawings first, then moved towards writing. I felt it was important for the students to understand that the quality of the ideas was more important than the mechanics of their written work.

The children's drawings, along with their talk with peers, acted as a support system that made their writing easier (Dyson, 1987). The drawings provided the students with a familiar way into an unfamiliar form of writing. As the children became more comfortable with recording their learning, ideas and questions in written form, they depended less on their illustrations to convey their whole messages.

Written Journal Entries

In this study the children were given a science learning journal in which they wrote after each hands-on science experiment. While the children wrote they were to keep in mind and respond to the questions: "What did you do?" and "What did you learn?" Fulwiler (1987) states that questions help focus the students to reflect on what they have learned. The data collected suggests that the children used their journals to explore ideas and assimilate and accommodate new knowledge. The children became aware of an audience, were

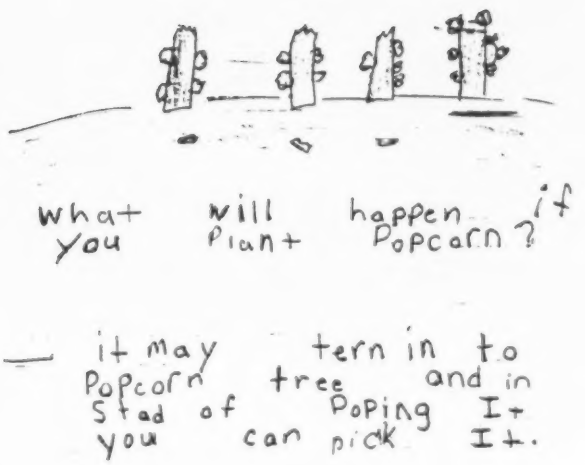
motivated to write, and their journal writing showed progress in organizing information and in the use of science and descriptive vocabulary.

Exploring Ideas

Kydd (1990) states that "young children are quick to observe, predict, make inferences, and solve problems--usually without realizing it" (p. 28). She believes that giving children the opportunity to write down their observations, predictions, inferences and solutions helps children become more aware of their thinking processes. "Journals solidify these process skills by making children think before they write" (p. 28). Kydd also says that writing helps reinforce science skills as the children "reflect on what they did and what happened in order to put it on paper" (p. 28).

As I read through the students' science learning journals I noted, as the study progressed, that most of the children's entries began to include personal inquiry questions, predictions and inferences. The children seemed to be actively exploring ideas and questions that had personally arisen from participating in group experiments. The children were taking the time to write their questions and predictions before carrying out a personal inquiry experiment.

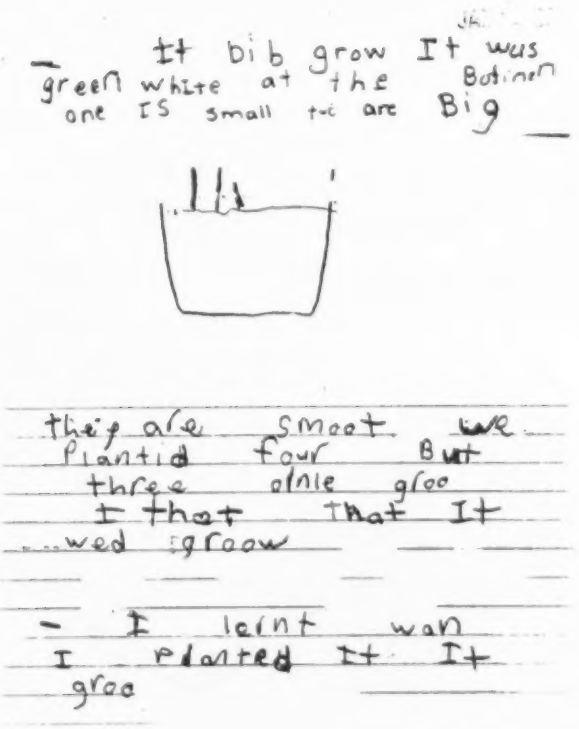
Wason-Ellam (1987, p. 10) states that "a crucial aspect of comprehension is the ability to ask appropriate and probing" questions. She goes on to say that "inquiry-centred writing helps students to understand and synthesize what they were learning" (p. 10).



What will happen if you plant popcorn? It may turn into popcorn trees and instead of popping it, you can pick it.

Figure 20: Eve's personal inquiry question.

Eve had wondered if a popcorn kernel, which is called a popcorn seed, would grow into a tree. She wrote down her question and prediction based on her wondering and the prior knowledge that most seeds turn into some type of plant. Eve planted the popcorn kernel and a few days later added the following to her previous journal entry:

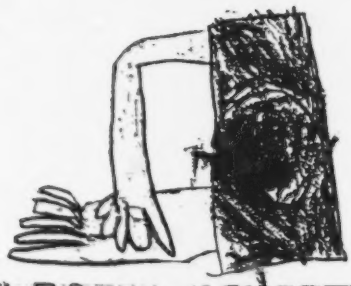


It did grow. It was green and white at the bottom. One [leaf] is small. Two are big. They are smooth. We planted four [seeds] but three only grew. I thought that it would grow. I learned when I planted it, it grew.

Figure 21: Eve's discovery to personal inquiry.

She had found the answer to her question and seemed excited that her prediction that the popcorn seed would grow into a plant seemed to be correct. This was illustrated when she wrote, "I thought that it would grow."

As part of the Change unit we had discussed that making an item cold or hot could cause change. Michael began to wonder about the popcorn seed which was changed by the heat from the popcorn machine. He wrote a personal inquiry question and prediction in his journal:



Will popcorn pop in our hands? I think so because our hands are hot.

Figure 22: Michael's personal inquiry question.

This experiment caught the attention of four other boys who joined Michael in conducting his experiment. The boys became very involved in the experiment and when it seemed that rubbing a popcorn seed between their hands didn't work, they tried rubbing two seeds together and rubbing the seed on the rug. I talked to the students about the experiment:

Mrs. O: Okay, guys, you have been rubbing for a long time --what happened?

All: Nothing.

Mrs. O: I wonder why?

Danny: I don't know.

Michael: Not enough heat.

Mrs. O: Pardon?

Michael: Not enough heat, because you need to stop once in a while and then all the heat goes away.

(Audiotape transcript, Jan. 22, 1992)

The others agreed or offered other suggestions. Michael wrote in his science learning journal:

No, it didn't change because it was slippery. Our hands did not get enough heat. I learned that popcorn doesn't change because it's slippery.

Figure 23: Michael's discovery to personal inquiry.

Michael, like Eve, had answered his wondering question. In Michael's entry, his prediction did not hold true. However, he was still excited with his discovery. Michael had displayed a greater understanding orally than in his written work but he had made a connection between the idea of the popcorn seed being slippery which made it fall out of their hands and which caused the "heat to go away". Michael and Eve were using their

writing "to find out about things, ask questions and to seek information" (Pinnell, 1975, p. 319). They looked for answers by forming questions and making predictions, and then conducted personal inquiry experiments.

Thompson (1990) states that through questions and predictions, children are making connections between new ideas and prior knowledge. This is a "skill central to taking the posture of active learner" (p. 45). Mayher, Lester and Pradl (1983) state this type of writing "depends upon an active rather than a passive approach to learning. It requires that we conceive of both learning and writing as a meaning-making process that involves the learner in actively building connections between what she's learning and what is already known" (p. 78). The children's journal entries let us truly see the "exposed edge of [their] learning" (Fillion, 1983, p. 702). The writing mirrored what the child was thinking at the time and let us in on how the child was connecting and assimilating the ideas. Eve knew all seeds grow and Michael knew heat changes items, and they applied this knowledge to new situations.

Motivation

Kydd (1990), Yates (1987) and Koeller (1982) all noted that the children "became highly motivated to write"(Kydd, p. 28) due to the hands-on experiments. They stated that the children wanted to capture their experiences on paper. "The children's writing flowed more easily and was more vivid because the children had had numerous" hands-on experiments (Koeller, p. 12). They also wrote that children who experienced trouble with writing still enjoyed writing in science.

The children in my study enjoyed and saw the value of writing in their science learning journals. This was evident in their comments to each other while writing:

Steven: I like this part. Science sure is fun!

Thomas: Ya!

Some children chose to write in their science learning journals during free time or center time. Michael wrote science questions on little cards for his friends to answer:

Figure 24. Michael's science question cards.

The children viewed the journal writing as an important part of science. During the study, one of our science lessons ran into recess time. Colin, who struggled with writing, said,

"Hey, we can't go outside. We didn't do our journals" (Nov. 28). MacAlister et al. (1991) stated that once the students get used to the science journals, they enjoy and expect to record something about what they have done. The children in this study often stayed after the lunch bell because they wanted to finish their journal entries.

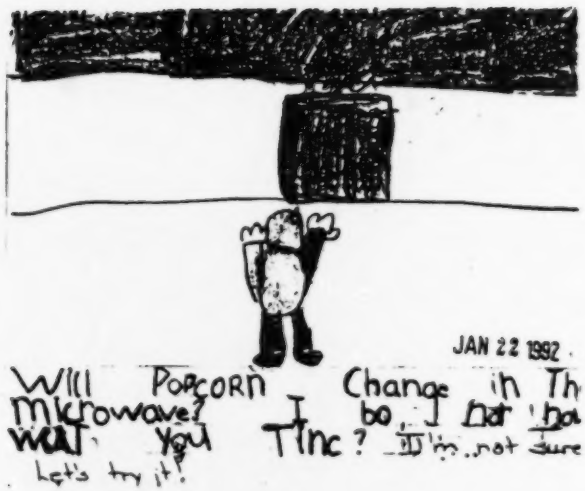
Awareness of Audience

Since the children were using expressive writing in their science learning journals, their entries often included oral expressions such as "Did you know?" and "Guess what?". This seems to indicate that the children were aware that I was going to read their journals and that I would be interested.

Another indication of audience awareness was that the children would write questions and leave spaces for me to respond:

Today we brought our jar. Some put an orange in. Some put pizza, some put eggs in, but I put butter, grapes and a pickle. This what it looked like. Do you think that looks good?

Figure 25: Excerpt of awareness of audience.

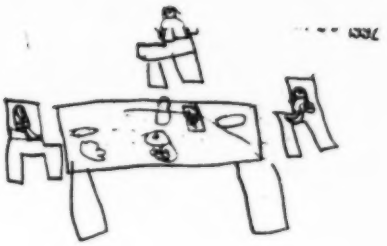


Will popcorn change in the microwave? I don't know. What do you think?

Figure 26: Question addressed to audience.

Organization of Information

In the beginning of this study the children's first entries consisted of one or two sentences which tried to explain what they felt they had learned. "Through the frequent entries, the children's writing took on greater expression and fluency" (Atwell, 1990, p. xviii) and began to contain chronological sequences of an experiment.

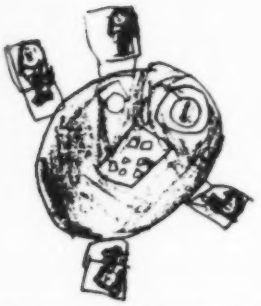


I got The contanr
AmaNDa Put The Milk
in The BaBY food Jar
ghD I PUt The Ice
M The contanr and
Kussandra got The Ice
and Kate got The
Popsucki Stick. We Shakeed it

I got the container. April put the milk in the baby food jar and I put the ice in the container and Kassandra got the ice and Katie got the popsicle stick. We shaked it.

Figure 27: Dawn's chronological entry.

In this example Dawn's entry was ordered chronologically to reflect the steps the girls took to complete the experiment. Dawn also included who was responsible for each step.



We maDe ice-cream
Useing A Baby food jar
And ice And salt
And Choc late milk
And the way we Did it
And Coffe Con tanre
And the way we uSeD it
①one Person puts milk on the
Jar②And then Put the liD on
③ put some ice ④then salt
⑤ Bady in the ice. ⑥ put more
ice in ⑦ put more salt ⑧
put the lid on And Shake
And when we open it
it was ice cream

We made ice-cream using a baby food jar and ice and salt and chocolate milk and the way we did it and coffee can container and the way we used it

(1) one person puts milk in the jar
(2) and then put the lid on
(3) put some ice
(4) then salt
(5) baby [jar] in the ice
(6) put more ice in
(7) put more salt
(8).. put the lid on and shake.

And then we opened it. It was ice-cream.

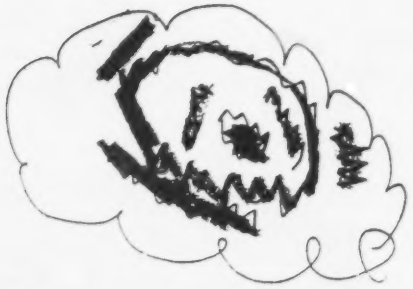
Figure 28: Jane's chronological entry.

Figure 28 shows how Jane wrote about the same experiment. She was playing with writing directions in her entry. On the next page she stated that "the ice made the milk freeze into ice cream".

Writing Styles

The children's journal entries tended to have a chronological order; however, their writing styles, as in Figures 27 and 28, were varied. I felt this was due to the mini-lessons that were at the beginning of some of the science lessons. The mini-lessons consisted of the class viewing one child's journal entry on the overhead projector and having them respond positively to their peer's written work. Calkins (1983) states that mini-lessons such as these help the "children become good writing teachers" (p. 126) as well as let them understand that there are many different writing styles.

As a result of the mini-lessons the children began to experiment with the different writing techniques that we had discussed as a class. This experimentation in turn had an effect on the children's writing progress. For example, Steven began this study writing strings of letters to represent words or sentences.



I learned when we do mix colors and we put 3 drops or 2 drops in the coffee filter, to make colors. And that can make blue and red, and pink and purple and green and orange.

Figure 29: Steven's first science journal entry.

This was Steven's first science learning journal entry. He had many gaps. Two of the mini-lessons dealt with detail and description of observations. Steven began to try to include these elements into his writing.

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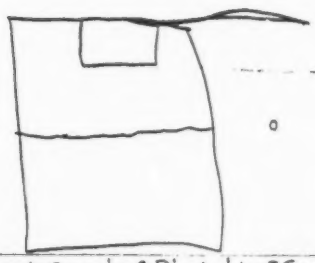


toDAY we are using Pickling SaLt it looks
Like rics AND TASLike SOLT

TO DAY we HADe A GLASS of WDDr
AND A STiK AND on THe STiK THer
Wos A BAG of PICK liNG SOLT We
POT THe PICKLING SOLT iN THe
GLASS I LORNT THOT ASOLiD YOUCAN.T
POT A STiK THrO iT. AND it DOSOLVD
AND We DID NOTSeeiT

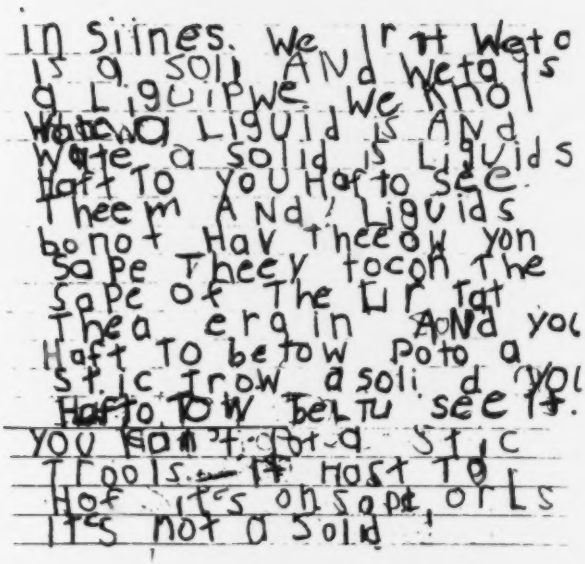
Today we are using pickling salt. It looks like rice and tastes like salt. Today we had a glass of water and a stick and on the stick there was a bag of pickling salt. We put the pickling salt in the glass. I learned that a solid [is something] you can't put a stick through. And it [pickling salt] dissolved and we did not see it.

Figure 30: Steven's last science journal entry.

Steven's entry not only demonstrates that his writing skills have progressed and that his writing is more organized, but it also shows that he had made connections between new knowledge and previous knowledge. Steven begins his entry describing pickling salt as resembling rice; he knew that a solid was something "you can't put a stick through" and that when something dissolves, you can't see it.

Thus, the mini-lessons not only helped Steven organize and present his ideas and thoughts more clearly; they also helped to "activate prior knowledge" (Wason-Ellam, 1987, p. 16) which is an important step in assimilating and accommodating new knowledge.

At the beginning of this study both Thomas' personal and science learning journal entries were very patterned. His first four science journal entries began with "I learned that--". As Thomas shared his science journal and participated in mini-lessons, he also began to try different approaches to his journal writing.



In science we learned there is a solid and there is a liquid. We know what a liquid is and what a solid is. Liquids have to, you have to see them. Liquids do not have their own shape. They take on the shape of the jar that they are in and you have to be able to put a stick through. A solid you have to be able to see it. You can't put a stick through it. Has to have its own shape or it's not a solid.

Figure 31: Thomas' last science journal entry.

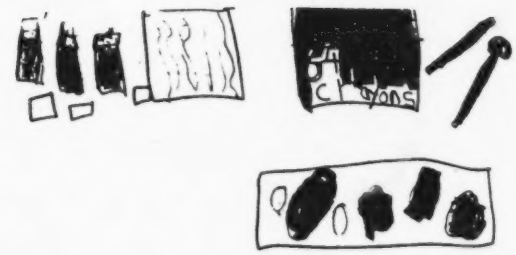
In this entry Thomas demonstrates that he has an understanding of what is a liquid and a solid. His writing style has changed from being "I learned that--" and "I like it" to being able to describe what criteria are necessary to determine what is a solid or a liquid. At the conclusion of this study Thomas' entries were usually two pages in length and

contained very detailed observations, procedures or definitions such as the example in Figure 31.

Vocabulary

Eve's, Dawn's and Michael's journal writing displayed growth similar to Steven's and Thomas'. Another similarity was the use of language in their written work. The children began to use more descriptive words and incorporated science vocabulary into their writing. Again, the mini-lessons could have been a contributing factor to this. Britton (1970) states that practicing subject vocabulary in order to make it one's own is similar to a doctor practicing medicine and a lawyer practicing law. He says that practicing, not repetition, is a purposeful way to use the terminology of a subject area. This doesn't make the difficult things easy, but he believes it makes it worth the struggle as the learner makes the new vocabulary meaningful.

While teaching the science lessons I would use science vocabulary (e.g., "primary colors"; "dissolved") and attempt to explain the terms in the children's language. I did not expect the children to use these terms in their discussions and writing; instead my goal simply was to expose them to the language hoping that someday the children might use these terms.



I LRT Th AT bAT IS NO+
The OLe SIe T A$ M+S
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I learned that paint is not the only thing that mixes. Food coloring can mix too and that you can use the primary colors in paint and they will mix but you can use the primary colors in food coloring.

Figure 32: Thomas' use of science vocabulary.

I responded to Thomas' entry to see if he understood the term primary colors.

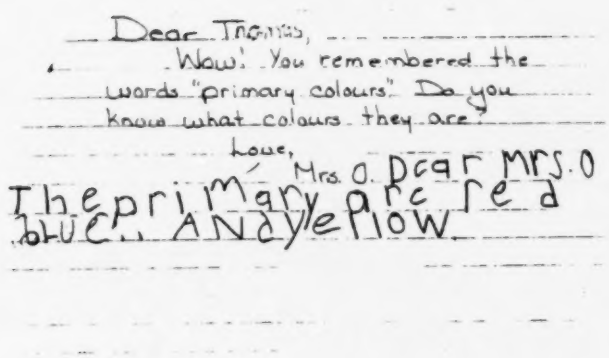

Figure 33: Thomas' response to researcher's question.

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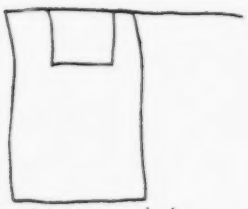


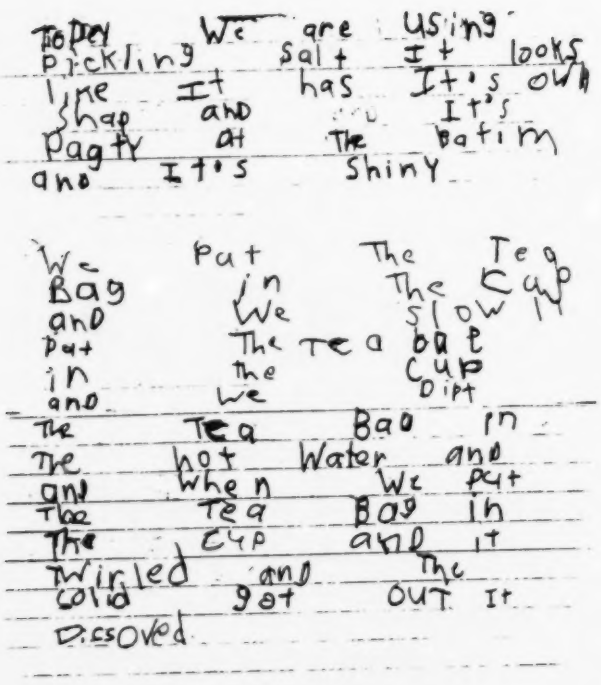
Will brown sugar dissolve in hot water?

TODAY WE HADE A BAG of brown sugar ALEN GOT TO DIP THE BAG in THE HOT WATER THE brown SUGAR did DISSO LVE. I NOTHAT THE WATER changed COLR BECOS THE SOGER dissoLVE

Will brown sugar dissolve in hot water? Today we had a bag of brown sugar. Alec got to dip the bag in the hot water. The brown sugar did dissolve. I know that the water changed color because the sugar dissolved.

Figure 34: Steven's use of science vocabulary.

Steven used the word dissolved and when I talked to him about his entry he said, "The sugar dissolved. . . you know, disappeared. It made the water brown. That's how I know it's there but I can't see it." It was apparent from this usage that Steven had the word dissolved in his working vocabulary and that.he understood the concept.



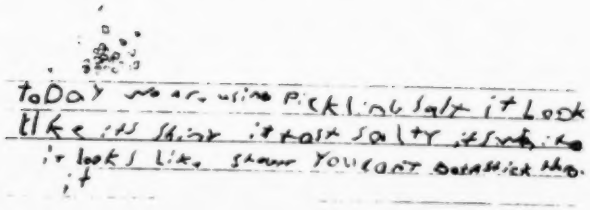
Today we are using pickling salt. It looks like it has its own shape and it's pointy at the bottom and it's shiny. We put the tea bag in the cup and we slowly put the tea bag in the cup and we dipped the tea bag in the hot water and when we put the tea bag in the cup and it [pickling salt] and swirled [it] and the solid got out. It dissolved.

Figure 35: Dawn's use of descriptive vocabulary.

By reading Dawn's journal entry we can see she has assimilated a number of ideas and terms which became a part of her action language (Barnes, 1975). She knew what a solid was and what dissolves means. Dawn also included descriptive vocabulary such as "slowly" and "twirled" in her written work. Dawn wrote about real experiences and made them her own. Thompson (1990) states that "summarizing is one way that children assimilate data and make it their own" (p. 48).

Attention to Detail

Thompson (1990) states that "the basis of all thinking is observation" (p. 39). Her study indicated that the children became more aware of their observations through writing in their learning logs which in turn made their observations more detailed. The children in this study also made more detailed observations as the study progressed and this was reflected in their journal writing.



Today we are using pickling salt. It looks like it's shiny. It tastes salty. It's white. It looks like sugar. You can't put a stick through it.

Figure 36: Michael connects prior knowledge to new situation.

Michael's writing shows that he has looked at the pickling salt very closely. He had made a number of connections to prior knowledge: "white", "looks like sugar",

"tastes salty" and has shown that he has assimilated what makes a solid by including one of the criteria: "You can't put a stick through it."

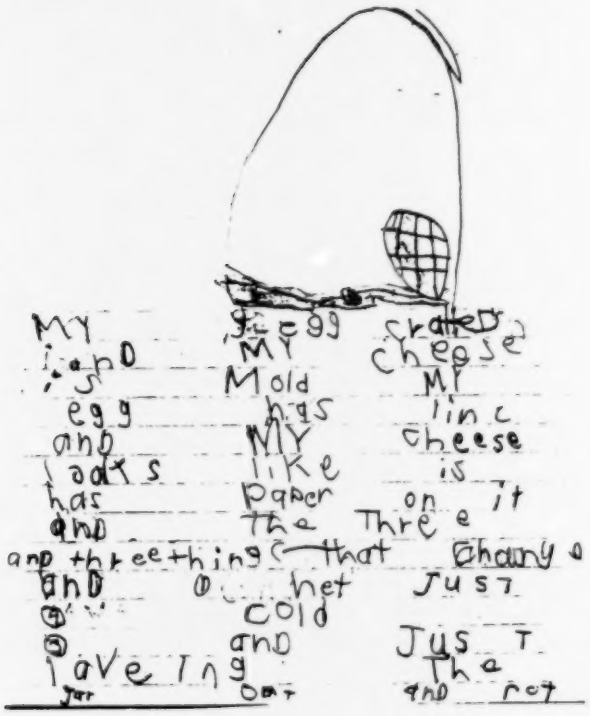
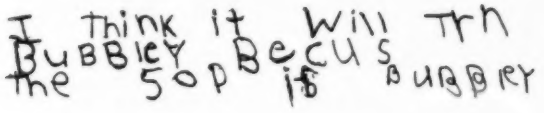

My egg cracked and my cheese is moldy. My egg has lines and my cheese looks like it has paper on it and there are three things that change:
(1) heat
(2) cold
(3) and just leaving the jar out and rot

Figure 37: Dawn connects prior knowledge to new situation.

Dawn made the comparison between the mold on her cheese ("looks like it has paper on it") because it was white and smooth.

Thompson (1990) stated that the children's learning logs allowed her to view each child's thinking. As I read over all the journal entries I noted the thinking that was evident in each entry. The children's writing opened a window to their thoughts that I otherwise would have never known about. Such is the case of Dawn who was very quiet during group discussions; however I could understand her thinking and the connections she was making through her journal writing.



I think it will turn bubbly because soap is bubbly.

Figure 38: Dawn's thinking made visible.

In the experiment Dawn was writing about, we put food coloring into whole milk. I had asked the children to predict what they thought would happen when the dishwashing soap was added. Dawn did not give her suggestion. Instead she wrote her prediction in her journal. The science journal provided a way for the shy children, and every child for that matter, to personally share thoughts and ideas with me.

Student Views of Journal Writing

Recent researchers stress that writing is a powerful tool for learning. It seems to be assumed that the children will enjoy using writing to learn and understand how it can be used to assist their own learning. I interviewed the five focus students in order to determine if the children did enjoy and value their writing to learn experience in science.

Steven, Thomas, Michael and Dawn stated that they preferred writing in their science learning journals and found it easier than their personal journal writing. Steven stated that his science learning journal was easier to write because:

> Steven: Science journal helps you learn more things. Other journal you have to think of words and in your science journal you don't have to do that, you just write. Because you only have to write about what you did and what you learned. The other one you have to make up stories and longer stories.
>
> Mrs. O: That's harder?
>
> Steven: Yup, because you really have to work on the journal instead of the science journal because the science journal are easy to do than the other journal. But in the one you have to do some other stuff and make up stories in your head and it's harder to do. In our other journal we imagine. We have to really work but in there [science journal] you only have to write things you <u>did</u> and what you <u>learned</u> in it.

Steven tried to articulate that he found his science learning journal easier because he knew what was expected, he knew what he had to write about, therefore he wrote about what he knew. He found "finding words" or ideas for his personal journal difficult.

Thomas agreed with Steven. He stated:

> Thomas: Usually my science journal because I always know something to write--I always know what I'm writing about.
>
> Mrs. O: That's difficult in your other journal?

Thomas: Yeah. Sometimes it's hard to think of an idea. You always have an idea in your science journal. Sometimes it takes a while to think of an idea for your other journal.

For Thomas, knowing what to write about made writing an easier task.

Michael enjoyed his science journal more "because I learn stuff that I can do at home". For Michael, his science journal writing had a definite purpose. He wanted to do the experiment again at home and by writing Michael would be able to remember what he needed and how to carry out the experiment.

Dawn enjoyed writing in her science learning journal "because you can tell about your experiment". Dawn, like Steve and Thomas, enjoyed writing about a hands-on experience; however she found creating a make-believe story easier. Dawn stated it was writing the questions and doing the experiments that made the science learning journal more enjoyable. She found making up stories easier because "you can't forget things". Dawn meant that she worried about forgetting steps when writing about an experiment but in a make-believe story "you can leave things out".

I asked the students why they felt they should write in their science learning journals. Eve, Dawn and Michael suggested that it was important to write about the experiment "so if you want to do it again you can" (Eve, Audiotape transcript, Feb. 28, 1992). Dawn added that writing was how real scientists remembered. Steven agreed and stated he wrote so that his "brain thinks about science". He also said he wrote "so you can remember what we did in science without forgetting".

Thomas discussed his science learning journal and stated that the writing helped him think about what he had learned. "When I'm writing, I basically am thinking about what we just did. You write cause if someday you want to do an experiment again and you can't remember, you just need to read your science journal over again." He said that his science learning journal helped him read and write "because you have to do a lot of writing and a picture. Then, we go read it to you or a friend."

I was impressed with how well the students expressed their ideas and thoughts. Their honest answers gave insight to their views of the purpose of their journal writing, how they felt about using writing to learn, and confirmed the researchers' theories.

Summary

Britton (1970) and Bruner (1988) believe that using writing to learn is a natural way for children to think, organize and construct meaning for themselves. The science learning journals provided the children who participated in the study with an ideal vehicle for thinking and making meaning out of their science experiences (Atwell, 1990). The children used their journal writing to explore ideas, make predictions, and to explain in their own language what they had learned and how it fit into their prior knowledge. The children's entries reflected the connections, relationships and how they built on prior ideas and knowledge. Britton (1967) wrote that one of the most important functions of writing for learning is that it enables the child to create a personal context for a new experience, idea, or fact. This is the substance of understanding.

The children's science learning entries reflected an awareness of an interested audience. Most of the children wrote statements such as "Guess what?" and "You know what I learned?" Some of the children wrote questions and left space for me to respond. There was a need for positive feedback and acknowledgement of their ideas and thoughts.

As the children were aware of an audience they also began to include science vocabulary and descriptive words as part of their journal entries. The children struggled to make the science vocabulary part of personal language so they practiced (Britton, 1970) using it when writing in order to clearly present their thoughts and ideas.

Mini-lessons (Calkins, 1986) seemed to be a factor which influenced the children's writing process. The mini-lessons presented ideas on different writing styles, techniques and how to comment on a peer's written work. These lessons helped create a safe enough environment that the children began taking risks with their writing by trying new styles. The result was that all the children had experimented to some degree with their writing and their journal entries became longer, more fluent and organized chronologically according to the steps taken in the experiments (Atwell, 1990· Wason-Ellam, 1987).

Pinnell (1975) states there is a need to provide materials that "bring forth the investigating or 'wondering' function of language" (p. 323). She feels that these types of activities give children the opportunity to use "language for learning" (p. 324).

The children in this study were using their written language "as a means of investigating reality, a way of learning about things" (Halliday, 1973, p. 14). They wrote down their questions and predictions, then tested their

knowledge of their world. This is the way children grow to understand the world they live in. By writing their wondering questions down, they also fastened their thoughts onto paper (Calkins, 1985) so they could explore their ideas when they chose to do so. Smith (1982) states that by writing our questions down we "overcome limitations of memory and attention" (p. 34). The children will be able to return and revisit their questions and predictions which will spur new ideas in the future.

Wason-Ellam (1987) stated that in her study, journal writing allowed her students to assimilate and accommodate new math knowledge. She wrote "journal writing allowed the students to reflect and generalize about experiences and encode that experience in a written form. . . [which] enabled it to be assimilated into the students' prior knowledge" (p. 16).

Before the students could write in their science learning journals, they needed to grapple with new facts and connect these facts to their prior knowledge. At the beginning of the study, the children struggled to shape, refine and organize their thoughts in writing in order to assimilate and personalize their learning. Many of the students began their early journal entries using "I learned that--". This pattern provided a way into writing in their science learning journals, for writing to learn was a new concept for the students.

The children's expressive writing in the science learning journals helped them to learn how "to think through writing" (Calkins, 1985, p. 190). Lindfors (1987) states that the more children use writing to learn, the more aware they become of their own thinking. "Awareness of one's own thinking marks a crucial step towards directing it" (Calkins, 1983, p. 136).

The children's science journal entries made their thinking visible and was "an excellent way to capture the

fleeting and sometimes extraordinary thoughts of young minds" (Kydd, 1990, p. 28). The children fastened their thoughts onto the paper (Calkins, 1985) and then were able to reshape, refine, reorganize and assimilate their new knowledge so that it would be easier to access for future use (Britton, 1970; D'Arcy, 1987).

The children's science learning journal writing is what Fillion (1979) describes as the exposed edge of the child's learning. The reader can see how the child is using her language to question, explore, explain and create meaning (Halliday, 1975). The children were actively engaged in their learning which was visible through their written words.

The children enjoyed and valued the writing in their science learning journals. They viewed their journal writing as a part of the science lesson and felt that they were not finished until they had finished their entries. They were enthusiastic and stayed with their writing until they felt it was finished because they could see that the writing "was serving some real, practical purpose. . . they were actively using written. . . language to get something done" (Newman, 1985, p. 152).

During their interviews the focus children stated that writing in their science learning journals helped them remember what they had done; they could do the experiment again and so they could think about what they had learned. Four of the focus students preferred writing in their science learning journals rather than in their personal journals as it was hard for them to come up with ideas for make-believe stories.

Chapter 7
CONCLUSIONS AND REFLECTIONS

In this study the children found learning through discovery an enjoyable way to learn science. This process enabled the children to explore and grow to understand the world they live in. Newman (1985) says that science also provides a wealth of opportunities for learning through both written and oral language. It was for these reasons that I chose to study writing to learn in science by having the students use a subject journal (Atwell, 1990; Fulwiler, 1987). The children used their science learning journals to write about what they had done and learned after each hands-on science experiment. The data suggests that: (a) talk played an important role in the students' learning and writing; (b) the children's illustrations preceded and then supported their writing; (c) science journals assisted children to explore ideas, predict and assimilate new information; and (d) the children enjoyed and viewed their journal writing as valuable to their learning.

Atwell (1987) states that learning is more likely to happen when the children are actively involved as learners and when they work in groups. Britton (1970) and Barnes (1975) believe that when children are learning they need to talk to their peers so that they can shape those new experiences into their own language which becomes more accessible for future use. Barnes refers to this as talking themselves into understanding.

The children's discourse in this study consisted of two types: talk during experiments and talk during various stages

of the children's journal writing. Britton (1970) states that "talk that goes along with activities. . . is essential to learning and in due course, moreover, writing grows from talk" (p. 130).

Talk during the experiments gave the children vital time to share observations, ideas and thoughts. The children used the discourse with their peers to construct their own understanding and make learning easier. The children's talk during experiments served five purposes: (a) to focus attention, (b) to add information, (c) to negotiate meaning, (d) to build community, and (e) to solve problems.

The children used their talk to focus one another's attention on certain aspects of what they were doing or observing during an experiment. By focusing one another's attention they were able to observe more than they may have on their own. As well, they extended each other's thinking when they shared their ideas or observations. The students were in control and directed their inquiries.

When children were given the opportunity to discuss their thoughts, ideas and observations, they began to entertain other possibilities and ideas which extended their learning. This sharing not only added to and broadened their knowledge, but the children became more articulate at expressing their thoughts.

While the children shared their thoughts, ideas and observations there were occasions in which the children had a clash in points of view. The children used their discourse to negotiate meaning. This type of talk does two things: forces the children to clearly articulate their points; and gives the opportunity for the children to try and see something from another's perspective.

The greatest benefit from the children's talk was how it built a sense of community which created an environment

conducive to learning (Dudley-Marling and Searle, 1991). The children built their learning community through listening, questioning, sharing, repeating information and affirming observations. This kind of interaction helped the children view themselves as scientists, teachers and learners who were active in their own learning and that of their peers (Calkins, 1986). This positive learning community also made it possible for the students to become more independent and learn how to work with others. Rosen and Rosen (1973) believe a sense of community "makes new kinds of communication and learning possible" (p. 43).

Talk was present through all the stages of the writing process. The children used talk to interpret, organize and make sense of their writing. Many of the children talked to themselves (Lindfors, 1987). Britton (1970) states that when children are allowed to talk before and while writing, their talk makes the writing easier and not such an overwhelming task.

All the children's illustrations in their science learning journals contained detail. How the childrens drawings changed or progressed over the course of the study seemed to depend on the students' writing ability. Students who struggled with writing continued to write less but put more effort into their drawings. Students whose writing skills were improving gradually moved towards longer, more detailed written entries and less detailed drawings.

The children's drawings, along with discourse with their peers, acted as a support system that made their writing easier (Dyson, 1987). The drawings provided a familiar way into an unfamiliar form--that of writing. As the children became more comfortable with recording their ideas, thoughts

and questions, then they depended less on their drawings to convey their whole message.

At the beginning of this study the children struggled to get their ideas into words, so they concentrated on their drawings. As the study progressed the children shared their journal entries and participated in whole class mini-lessons. These factors had positive effects on the children's writing process because they began to experiment with their writing styles. The children were experimenting with which styles would work best to explore their ideas, record their questions and predictions, as well as let them make connections and see relationships between new and old knowledge.

The children stated that they felt the science journals were enjoyable and could see how the writing assisted their thinking, remembering, understanding and learning. Their writing let them explore what they had learned and experienced (Koeller, 1982) and let them make it their own (Britton, 1970).

Conclusions

Giacobbe (1986) wrote:

> A productive classroom in any subject should provide opportunities for the students to wonder, to pose questions, to pursue possible answers, to discuss with others, to come to some conclusions--all in writing and all in an attempt to come to a greater understanding of what they are trying to learn. (p. 147)

For me, Giacobbe's statement sums up writing to learn and the results of this study. They both support the view that writing to learn is an active, personal learning process. Britton (1967) stated that children need to first do, then talk and it is only then that they can write. The children in this

study experienced the experiments, then discussed their observations with their peers and me so that they could practice putting their learning into words before they wrote in their science learning journals. This way the students interacted with and explored the material while applying it to prior experiences. The knowledge then became "a personal possession based on the knower's experience" (Wason-Ellam, 1987, p. 22). The children were not reciting information and facts; they were actively engaged in personalizing their learning which was enhanced by discussions with others and by writing about their learning using their own words. Hence "writing is a powerful tool for making sense of experiences" (Atwell, 1990, p. viii).

This study suggests that writing is not an isolated activity that can only be used in language arts. As teachers we must recognize that writing assists children's learning and can be used in all subject areas. Writing to learn gives us the key that unlocks the doors which segregate our curriculum so that children can explore connections among the subject areas. Writing to learn gives us and our students a very valuable and precious window to their minds so that as teachers we can meet their needs, broaden their knowledge and challenge each child.

Reflections

At the completion of the research and writing of this thesis I felt it was important to take time to reflect on how this experience has affected me, my learning, and my teaching style. I learned about how to talk, listen, and learn from my students. I also learned how to incorporate writing to learn as part of my science program.

As I collected audiotapes of children's discussions, read journal entries, and conducted student interviews, I was amazed by the children's ability to articulate their learning. The five focus children each explained how they approached their journal writing, what they did first (draw or write) and what they were thinking as they wrote. During my interviews with the children we had interesting discussions regarding which journal, personal or science, they enjoyed and found easier to write in. It was an eye opener for me to listen as each child gave a choice and explanation. I had never had discussions like this with my students before. It had never crossed my mind that I should. Yet, as I listened, I realized how much I had been taking for granted over my years of teaching. I had always assumed the role of expert and had made decisions as to what books, teaching methods or techniques would work well for each child. I learned that I should have been getting some input from my students, as they were very capable of talking about what work they do in the classroom that makes learning easier for them.

I have always centered my writing program around personal journals. I had believed that giving the children the opportunity to choose their own topic made learning to write easier and more enjoyable. It was my hope that the children would become efficient and effective writers as they would be writing more often due to the enjoyment and success the journal writing experience gave them. I was then surprised to learn, through the student interviews, that most of the children found the science learning journals easier and more enjoyable because they knew what they were going to write about. As Steven said, "I don't have to think of the words". Because he had lived the experience just moments before, it was easier to write about what he had done and had learned. In

a personal journal it's difficult "thinking up words" to a story, because "you have to make up what comes next" (Steven, Feb. 28).

My initial belief that personal journal writing was easier for children was not true for all students. It is obvious that in future teaching situations, I will need to provide a variety of writing opportunities in all content areas so that I can better reach the needs of all my students.

I began to question why most of the students preferred to write in their science learning journals. Heath (1988) had concluded her article on journal writing by stating that journals were a powerful learning tool if the teacher provides the students with some structure. I think the focus questions, "What did I do?" and "What did I learn?" provided the type of structure Heath was talking about. The questions formed a frame in which the children were free to choose how to write in order to create the picture.

The structure of the science learning journals had a surprising effect on the two English as a Second Language (E.S.L.) students and two learning disabled students in the classroom. The structure seemed to provide a way into writing for these children. Ken, an E.S.L. student, would only write strings of letters in his personal journal, yet he would struggle and complete one full sentence using invented spelling in his science learning journal. I had noted in my field notes that after a month of writing in his science learning journal he began to write sentences using invented spelling in his personal journal. The other special needs children had similar experiences.

I had not given much thought to the comments I had written in previous years in student journals. However during this study I made an effort to write comments or questions in

regard to the children's written ideas. I was surprised that the children noticed in our interviews the difference between Mary's and my written comments in their personal journals. Eve said, "You write and ask us questions and Mrs. C. writes compliments." Steven agreed and stated he liked being asked questions "because it teaches you". The children seemed to enjoy the fact that I responded to their ideas and asked questions. They stated this was another reason they enjoyed their science learning journals. I wondered how the children would respond if I wrote similar comments and questions in their personal journals and what effect it would have on their writing.

Peer interaction has long been an important aspect of my classroom. I had often stopped and wondered if I was only giving the children social experiences but felt that it was more beneficial than detrimental. My mind was put at ease as I listened to the many audiotapes of the children talking together. They surprisingly stayed on topic for most of the time and, as well, they challenged and extended ideas, considered new ideas and supported one another. It became very clear to me that the children were engaged in a valuable learning experience. The children's discourse also provided an opportunity for them to bounce their ideas off one another before writing. It was gratifying to listen to the children taking an active role in their own learning and their friends' learning. My speculation/hypothesis was confirmed that allowing children the opportunity to talk provides a rich learning environment.

This research, along with other studies I conducted during my graduate program, has forever changed my teaching. I was forced to truly listen and attend to the children's needs in my role of teacher researcher. As a result I did what I feel

was my best teaching. I took the time to watch, listen, discuss with and guide the children instead of being in a hurry to "cover the curriculum". Upon reflection I realize that the children covered most of the curriculum requirements through their individual inquiries without me directly teaching the elements. It demonstrated to me that teachers should take their lead from the children and guide their inquiries so that the children initiate and explore further study from their sense of curiosity. It seems to me that this is a much more enjoyable, valuable and more meaningful way to learn. This way everyone is a teacher and a learner, which creates an exciting learning environment.

The writing of this thesis enabled me to experience writing to learn firsthand. I often began my writing with half-formed ideas and thoughts in my journal that grew together as I saw connections between ideas as I reread my written work. Sometimes I was surprised at what I wrote, for when my pencil touched the paper, ideas that I hadn't thought of before flowed out onto the page. It was exciting to view my own thinking and learning throughout this project.

I was aware that I had learned a great deal from conducting this study. I spent numerous hours sharing my findings with my advisor, family and peers throughout this whole process. I discovered firsthand that one can talk oneself into understanding (Barnes, 1975) and that this type of discourse makes writing easier and not such an overwhelming task (Britton, 1970).

My writing allowed me to capture my ideas in a way not possible through talk so that I internalized, reorganized, refined and reflected on my ideas and thoughts. It was exciting to view my thinking on paper. The writing process deepened and broadened my learning as I made connections that

I hadn't previously been aware of. As I finished pieces of my writing I felt excitement and pride that comes from personalized learning. I hoped that the students who participated in this study had felt the same way about their journal entries.

Before embarking on my graduate studies I had been toying with the idea that teachers should write at the same time as their students. I thought that if we write with our students they would be able to see us struggle at times to find just the right word or format. Writing this thesis reinforced this idea and made me understand that by being a writer with the children I could sympathize with the difficulty that sometimes arises from writing. I would then be able to share my experiences, offer suggestions or just listen and understand.

I also learned that implementing theories is often more difficult than I had previously perceived, but it is well worth the effort. One should not expect to become an expert on the first try. It has taken me three years to find a successful format for implementing writing to learn in science. However, I can't stop here. In the next year I will try, with my students' help, to refine the process again. I see it as a continual learning process, for new groups of children will take me to new understandings and discoveries. I view myself as a learner in the classroom and my teachers are the students. Hopefully we can learn from each other. We can always ask questions and seek out the answers. As Donaldson (1979) has so succinctly written:

We are, by nature, questioners. We approach the world wondering about it, entertaining hypotheses which we are eager to check. And we direct our questions not just to other people but to ourselves, giving ourselves the job of finding the answers by. . . exploration of the world. (p. 67)

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